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BRITISH ZOOPHYTES.

VOL. I.

"Antequam progrediar, non ab re fortasse fuerit objectioni alicui quæ in me moveri potest occurrere. Non deerit scilicet qui me vanæ curiositatis arguat, quòd res adeo viles et abjectas, nullius in vita usûs, indagaverim, iisque describendis tantum temporis et operæ impenderim.——Cui respondeo, Quod DEI opera sunt in quibus contemplandis memet exerceo: quod Divinæ Artis et Potentiæ effecta, quibus exquirendis subsecivas horas addico: quod ILLE me in hunc mundum introduxerit, tam inexplicabili rerum varietate instructum et ornatum; quod oculis, quos mihi contulit, ea videnda, animo consideranda objecerit. In DEI ergo contumeliam redundat, quod hæc, quæ eum creâsse negare non audes, supervacanea et inutilia esse affirmes.——Dices, Majora et magis necessaria studia sunt, quæ totum hominem requirunt. Respondeo, Majoribus istis me majorem curam impendere, interim tamen minora hæc et leviora non opus est ut prorsus negligam: Utrique penso sufficio; utrique temporis abunde suppetit, modò id prudenter dispensem, modò caveam ne qua ejus pars omnino vacua præterlabatur. *Vitam* (ut rectè Seneca) *non accepimus brevem sed fecimus, nec inopes ejus, sed prodigi sumus.* Deinde Medici etiam severiores aliquam temporis portionem recreationibus deputant. Hisce ego studiis et inquisitionibus memet recreo et oblecto. Quod alii venationibus, aucupiis, confabulationibus, lusibus insumunt, illud ego "Zoophytis" indagandis, colendis, contemplandis impendo. Recreat et refocillat animum, quamvis laboriosum sit, illum quocunque oblectatur."—RAIUS.

A

HISTORY

OF THE

BRITISH ZOOPHYTES.

BY

GEORGE JOHNSTON, M.D., LL.D.,

FELLOW OF THE ROYAL COLLEGE OF SURGEONS OF EDINBURGH.

IN TWO VOLUMES.—VOL. I.

SECOND EDITION.

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TO

SIR WILLIAM JARDINE, BARONET,

OF APPLEGARTH, DUMFRIES-SHIRE,

AND TO

PRIDEAUX JOHN SELBY, ESQUIRE,

OF TWIZELL-HOUSE, NORTHUMBERLAND,

WHOSE FRIENDSHIP

HE MUST EVER RECKON AMONG THE MOST VALUABLE FRUITS

OF HIS

STUDIES IN NATURAL HISTORY,

This Work

IS RESPECTFULLY DEDICATED BY

THE AUTHOR.

PREFACE

TO THE SECOND EDITION.

In preparing a second edition of this work for the press, I have endeavoured to incorporate in it the species which have been discovered since its first publication; to correct the nomenclature and synonymy throughout; to amend the descriptions, and to add such additional particulars of the habits and external anatomy of the species as have come to my knowledge. It was deemed unnecessary to enter into minute details of the internal structure of these animals; and the intimate anatomy of their tissues and organs has been entirely omitted, for I am convinced that it is now time to separate such details and discussions from descriptive natural history.

To aid my wish to make this history more complete, my friends have come forward with zealous alacrity, and it would need strong words to convey to them, and to my readers, the sense I have of the value of their co-operative assistance. That assistance has, I trust, been acknowledged in its place,—it would pain me to find any omission,—but here I would, on parting, again tender my thanks to William Thompson, Esq., of Belfast; to Professor Edward Forbes; to Mr. A. H. Hassall; to Mr. C. W. Peach; to the Rev. David Landsborough; to Lieut. Thomas, R N.; to Mr. Cocks of Falmouth; to Mr. Couch; to Mrs. Griffiths, Miss Dale, and Miss Ellen Forster; to Mr. Bean; to Professor John Reid; to Professor Allman;

to W. W. Saunders, Esq.; to Mr. Joshua Alder; to Mr. Price and Mr. R. Patterson; and to Dr. George Wilson and my long tried friend, Dr. William Baird.

Again I have to disclaim any title to be considered an original observer; I appear in the character of a compiler, anxious, however, to deal honestly with the works and researches of the labourers in this department of nature. Foreign authors sometimes complain of the neglect of their writings from English naturalists, who may again retort the charge, but there is injustice in the complaint on both sides; the neglect proceeding, as I am convinced, solely from the great difficulty of procuring the books that have been unquoted. I am in this predicament, having failed to get some continental works which have a high reputation.

Berwick-upon-Tweed,
April 6, 1847.

PREFACE

TO THE FIRST EDITION.

Since the publication of Ellis's Essay on Corallines in the year 1755, no separate work has appeared in illustration of our native Zoophytes. In the meantime, and more especially within these few last years, a much more accurate knowledge of their structure has been attained, and many species have been added to the list; and it has been my object to give here an account of these discoveries, to connect them with what had been previously made known, and to combine the whole under a system more in harmony with the anatomy of the objects than has hitherto been done. If I have succeeded in bringing within a convenient volume, the materials that at present lie scattered through many expensive and miscellaneous ones, some of them too of difficult acquisition, I may, perhaps, claim the merit of having conferred no inconsiderable benefit on the student, even should his future studies convince him that I have not forwarded or enriched this particular branch of natural history by any novelties. Originality indeed has been less my aim than fulness and accuracy of compilation; but I have endeavoured to qualify myself for this apparently humble task, by many personal researches and observations on the species that are found in my own neighbourhood, under the conviction that a compiler will rarely succeed in giving a correct idea or representa-

tion of the objects under investigation without a direct acquaintance with them. It is indeed desirable that the author of a work of this kind should have examined all the species, and in various distant localities, that he may justly characterize them, and estimate the extent of their variations; nor was the circumstance of the comparative unmovableness to which a medical practitioner is doomed unconsidered as a bar to my own competency, but the love of the subject prevailed, especially when friends were readily found to contribute to the removal of the difficulty. To them I have in this place to render my grateful acknowledgments. To Mr. Bean of Scarborough, Dr. Coldstream of Leith, J. V. Thompson, Esq., Inspector of Hospitals, for some time resident in Cork, and the Rev. David Landsborough of Stevenston in Ayrshire, I stand indebted for numerous specimens; and similar communications of less extent have been sent me in a friendly manner by John Edward Gray, Esq., of the British Museum; Mr. Robert Embleton, surgeon in Embleton; Messrs. Alder and Bowman of Newcastle; Mr. Teale of Leeds; J. Hogg, Esq., of Norton; and Messrs. Macgillivray and P. W. Maclagan of Edinburgh. One other name must not be forgotten, for, besides a friendly interest in the book, and his revision of it during its progress through the press, I have had the kind assistance of the Rev. Thomas Riddell, of Trinity College, Cambridge, whenever the assistance of a classical scholar was required.

I am not certain that any apology will be deemed necessary for the notes and quotations which have been introduced with considerable liberality, for the tastes of the naturalist have ever seemed to me akin to those of the antiquary; and this has always been a favourite mode of illustration with the latter. It is one that chimes in with my own humour, and the indulgence of it seemed at least harmless on the present occasion. Many of these notes are devoted to notices of

the individuals who, so far as I could learn, were the first to notice the species of zoophyte to which their names are respectively affixed,—following immediately the specific character. This has been a pleasing inquiry. Smit with the beauty—real or fancied—of the objects of his study, a curiosity is naturally awakened to discover the name and degree of the person who had first deemed it worthy of his examination and participated in our pleasure, for we conclude assuredly that he who had taken the trouble to record the name and treasure up the object, was one of like mind, and imbued with much of the same affections and dispositions as ourselves. Some of them were found to be men of renown, others, in whom I felt a deeper sympathy, are now forgotten, their name and their labours swallowed up in the higher and more enduring reputation of those whom they were honoured to assist and delighted to serve. The genuine naturalist will not censure this "fond attempt" to restore the faint traces of men who had sought the best occupation of a leisure hour in congenial pursuits and studies; but rather will with me lament the obscurity and shortness of their "simple annals."

> "Paullum sepultæ distat inertiæ
> Celata virtus. Non ego te meis
> Chartis inornatum silebo,
> Totve tuos patiar labores
> Impune——carpere lividas
> Obliviones."*—Hor. *Carm.* iv. 9.

It was gratifying to remark that most of my predecessors in this field of inquiry, were members of the medical profes-

* The first stanza in Shenstone's "Schoolmistress" may serve as a translation of this passage:

> "Ah me! full sorely is my heart forlorn,
> To think how modest worth neglected lies:
> *   *   *   *   *   *
> let me try
> To sound the praise of merit, ere it dies,
> Such as I oft have chanced to espy,
> Lost in the dreary shades of dull obscurity."

sion. How largely natural science, in all its branches, has been indebted for its progress to this body is too notorious to be insisted on; but it has been less noticed, that the men who thus occupied themselves in acquiring and forwarding a knowledge, which many may deem purely ornamental, were the same individuals who were most engaged in the active discharge of the duties of their profession, and the most instrumental to its advance. Boerhaave, Cullen, Hunter, Darwin, and Jenner are very memorable instances of this fact, which is illustrated with lesser brilliancy in Lister, Sloane, Mead, Fothergill, Lettsom, Sims, Maton, in Withering of Birmingham, in Percival and Hull of Manchester, in Pulteney of Dorset, Stokes of Chesterfield, and numerous others, whose names will occur to every one conversant with the history of medicine. This is only what, on reflection, might have been anticipated, for that very activity of mind and perspicacity which originated and upheld their sagacity and success as practitioners, were sure to carry them far in whatever side-path the natural bent of their taste led them, for the occupation and entertainment of the leisure hours which the busiest must have or may create. Idleness has no leisure. Were it necessary I might safely shelter myself under the cover of these exemplars, in the contemplation of whose lives I have often nurtured my love to my profession, —and hence, perhaps, an ambition to follow them even at a far distance; but there never was a time when it was necessary to vindicate to any but the ignorant, the erratic excursions of medical men into the fields of science and literature, for assuredly the rank which the profession, as a body, has taken and holds in public estimation, depends for its patent, in part at least, on the scientific and literary character of its professors; and by continuing to support that character they will best secure it from the vulgarity of a common mercature, or the selfishness of a venal quackery.

Zoophytes present to the physiologist, the simplest independent structures compatible with the existence of animal life, enabling him to examine some of its phenomena in isolation, and free from the obscurity which greater complexity of anatomy entails: the means of their propagation and increase are the first of a series of facts, on which a theory of generation must rise; the existence of vibratile cilia on the surfaces of membranes, which has since been shewn to be so general and influential among animals, was first discovered in their study; and in them are first detected the traces of a circulation carried on independently of a heart and vessels.* The close adhesion of life to a low organization; its marvellous capacity of redintegration; the organic junction of hundreds and thousands of individuals in one body, the possibility of which fiction had scarcely ventured to paint in its vagaries, have all in this class their most remarkable illustrations. On the geologist zoophytology has peculiar claims. Its subjects are, apparently, the first of animals which were called into existence; and from that high date to this time, they have played a part in the earth's mutations, from chaos to the present well ordered scene, greater perhaps than any other class of beings. Separating from the waters of the ocean the calcareous matter held in solution, they reduce it to a solid state; constructing therewith their varied polypidoms or corals which, by their continual growth, their coalescences, their enormous numbers and extent, first roughen the smooth basin of the sea, raise up reefs and ridges that obstruct the hitherto open course of navigation, and become ultimately the foundation of islets and islands that remain the "monumental relics" of the puny race. As now the process and change goes on in tropical seas,—so operated it, in the preada-

* On the importance of the study of inferior organisms to the physiologist, see Carpenter's General and Comparative Physiology, p. 4; and Owen's Lectures on Invertebrate Animals, p. 5. (Note to 2nd edit.)

mic times, over the waters of the globe, for it is principally from the debris of polypous excretions, that the extensive beds and quarries of chalk and limestone, which are found in every region of the globe, take their original.* But it is to the zoologist that I exclusively address myself in this work, and however considerations like the above may enhance the importance of the subject in the estimation of others, they sway him little, and lie apart from his more immediate objects. He finds his pleasure in the contemplation of their novel forms, in the examination of those characters which distinguish them as species, in the quest of their mutual affinities, their relations and analogies with other beings, the order in which Creative Wisdom may seem to have called them into existence, their habits, economy, and uses; and in all these things he is ever watchful to find a "moral compliment," that the pursuit to which his taste and constitution of mind has led him, may be neither uninfluential nor virtueless on his heart.

The plates and wood-cuts which illustrate the volume are, with few exceptions, original, engraved from drawings made for it by Mrs. Johnston, who is herself the engraver of fourteen of them. The naturalist who may have attempted similar illustrations will appreciate the labour, perseverance, and skill which has been bestowed upon them, and will not harshly censure any errors of detail which a minute criticism may discover. As I could not have undertaken this history without her assistance, I may crave, from any one who shall find a merit in it, the ascription of that merit to my colleague.

* See Lamarck's Anim. s. Vert. ii. 10.

Berwick-upon-Tweed,
August 15, 1838.

CONTENTS.

THE

BRITISH ZOOPHYTES.

When the word "Zoophyte" began to be used by naturalists, it designated a miscellaneous class of beings, which were believed to occupy a space between the animal and vegetable kingdoms, and where the characteristics of the subjects of each kingdom met and were intermingled. They were of a "middle nature," not because of their outward resemblance to plants, but because they were deficient in the more obvious qualities of animals. Almost insensible and immotive, their weak and obscure life was regarded as one merely of vegetation, engendered in them by putrefaction or fermentation, and unsusceptible of the volitions and passions which move and agitate higher entities. Thus the term indicated a mingled life or constitution, and had no reference to figure; but, some time after, when it had been allowed on all hands that the productions in question were altogether animal, another class of objects, hitherto registered amongst vegetables, was ascertained to be also of animal origin; and as their similitude to mosses and lichens, to sea-weeds and mushrooms, was undeniable, and indeed so remarkable as to have long veiled their nature from us, then the term "Zoophyte" was transferred to this newly-discovered order, and has since been applied by the majority of English naturalists to it alone. With Continental naturalists the word has still its widest application, embracing, in their nomenclature, not merely those polypiferous beings which cover the bottom of the ocean with a singularly exact mimickry of vegetation, but also the star-fishes and sea-urchins, the sea-figs and sea-nettles or jelly-fish, and even the intestinal worms;—but this extensive acceptation can scarcely be

justified on the score of verbal accuracy, and is opposed both to zoological and vulgar usages. In this work I use the word in its restricted sense, as it was used by Ellis and Solander,—or rather with a still narrower circumscription, having assigned what appear to be sufficient reasons for removing the Corallines and Sponges from the category. The definition of a Zoophyte is thus considerably simplified, but there still remains sufficient variety of structure in the constituents of the order to render that definition vague, and, perhaps, practically useless. Zoophytes are all aquatic, avertebrate, inarticulate, soft, irritable, and contractile, without a vascular or separate respiratory or nervous system. The alimentary canal is very variable, but the aperture to it is always superior, circular, edentulous, and surrounded by tubular or, more commonly, by filiform tentacula. Many are asexual, and it is doubtful whether any species has distinct sexes.—The individuals (Polypes) of a few families are separate and perfect in themselves, but the great majority of Zoophytes are compound animals, viz. each zoophyte consists of an indefinite number of individuals or polypes organically connected, and placed in calcareous, horny or membranous cases or cells, forming, by their aggregation, corals or plant-like Polypidoms.

As thus defined, our Zoophytes are referable to two of the primary divisions of the animal kingdom,—the Radiated and the Molluscan,—and consequently constitute two classes distinguished by a very remarkable dissimilarity of organization. These classes have been named Anthozoa and Polyzoa, and may be shortly characterized thus:

I.—Anthozoa. Body tending to globular, contractile in every part, symmetrical: mouth and vent one: gemmiparous and oviparous.

II.—Polyzoa. Body elongate, syphonal, non-contractile, and unsymmetrical: mouth and anus separate: oviparous.

CLASS

ANTHOZOA.—EHRENBERG.

ANTHOZOA, *Ehrenberg* Corall. des roth. Meer. 31.—RADIATED ZOOPHYTES, *Johnston* in Mag. Zool. and Bot. i. 447.—ZOOPHYTA, *J. E. Gray* in Syn. Brit. Mus. 128.—POLYPS, *Jones* Anim. Kingd. 17-50.—POLYPI, *Owen* Lect. 81.

Fig. 1.

PLUMULARIA CATHARINA.

"Involved in sea-wrack, here you find a race,
Which Science, doubting, knows not where to place;
On shell or stone is dropp'd the embryo seed,
And quickly vegetates a vital breed."—*Crabbe.*

The ANTHOZOA are divisible into the following Orders:

I.—HYDROIDA. *Polypes* compound, rarely single and naked, the mouth encircled with roughish filiform tentacula; stomach without proper parietes; intestine 0; anus 0; reproductive gemmules pullulating from the body and naked, or contained in external vesicles.—*Polypidoms* horny, fistular, more or less phytoidal, external.

II.—ASTEROIDA. *Polypes* compound, the mouth encircled with 8 fringed tentacula; stomach membranous, with dependent intestinal appendages; intestine 0; anus 0; ovules produced interiorly.—*Polype-mass* variable in form, free or permanently attached, carnose, generally strengthened with a horny or calcareous axis enveloped with the gelatinous or creto-gelatinous crust in which the polypes are immersed, and which open on the surface in a starred fashion with 8 rays.

III.—HELIANTHOIDA. *Polypes* single, free or permanently attached, fleshy, naked or encrusted with a calcareous *polypidom*, the upper surface of which is crossed with radiating lamellæ; mouth encircled with tubulous tentacula; stomach membranous, plaited; intestine 0; anus 0; oviparous, the ovaries internal.

ANTHOZOA HYDROIDA.

Les Sertulairiens, *Audouin* and *M. Edwards* in Lam. Anim. s. Vert. ii. 105.—Zoophyta Hydroida, *Johnston* in Mag. Zool. and Bot. i. 447.—Polypiaria, *J. E. Gray* in Syn. Brit. Mus. 133.—Nudibrachiata, *Farre* in Phil. Trans. an. 1837.—Hydrozoa, *Owen* Lect. 82.

"As for your pretty little seed-cups or vases, they are a sweet confirmation of the pleasure Nature seems to take in superadding an elegance of form to most of her works, wherever you find them. How poor and bungling are all the imitations of art! When I have the pleasure of seeing you next, we will sit down, nay kneel down if you will, and admire these things."* Thus did Hogarth—our great moral painter—write to Ellis in evident reference to the zoophytes of the present order; and he must indeed be more than ordinarily dull and insensate, who can examine them without catching some of the enthusiasm of the artist. They excel all other zoophytical productions in delicacy and the graceful arrangement of their forms; some borrowing the character of the prettiest marine plants, others assuming the semblance of the ostrich-plume, while the variety and elegance exhibited in the figures and sculpture of their miniature cups and chalices is only limited by the number of their species.

The Hydroida vary from a few lines to upwards of a foot in height. They are all, with the exception of the Hydra and Cordylophora, marine productions, and are found attached to rocks, shells, sea-weed, other corallines, and to various shell-fish. Many of them appear to be indiscriminate in their choice of the object, but others again make a decided preference. Thus Thuiaria thuja prefers the valves of old shells, Thoa halecina is more partial to the larger univalves, Antennularia antennina grows in coarse sand on rocks, Laomedea geniculata delights to cover the broad frond of the tangle with a

* Lin. Corresp. vol. ii. p. 44.

fairy forest peopled with its myriads of busy polypes, while the Sertularia pumila rather loves the more common and coarser wracks. The choice may in part be dependant on their habits, for such as are destined to live in shallow water, or on a shore exposed by the reflux of every tide, are in general vegetable parasites; while the species which spring up in the deep seas must select between rocks, corallines or shells,—the depths at which they are found being too great for the vegetation of sea-weed.*—The more robust tribes grow erect, and, being flexible and elastic, yield readily to the waves and currents; but some of the very delicate species avoid a shock for which they are unequal, by creeping along the surface.

A very few of these zoophytes are naked, but in the majority the soft body is invested with a horny sheath that is called the *polypidom*. This offers us many specifical varieties, and, in general, is confervoid and more or less divided, the ramifications being disposed in a variety of elegant plant-like forms. The stem and branches are alike in texture, slender, horny, fistular, and almost always jointed at short and regular intervals, the joint being a mere break in the continuity of the sheath without any character of a proper hinge, and evidently formed by regular periodical interruptions in the growth of the polypidoms. Along the sides of these, or at their extremi-

Fig. 2.

* Lamouroux says, "We find some polypidoms placed always on the southern slopes of rocks, and never on that towards the east, west, or north. Others, on the

ties, we find the denticles or cuplike cells of the polypes arranged in a determinate order, either sessile or elevated on a stalk. (Fig. 2, *a*.) Though of the same substance, the cell is something more than a simple expansion of the stem or branch, for near its base there is a distinct partition or diaphragm on which the body of the polype rests, with a plain or tubulous perforation in the centre, through which the connection between the individual polype and the common medullary pulp is retained. Besides the cells there are found, at certain seasons, a larger sort of vesicles (fig. 2, *b*), readily distinguished from the others by their size and the irregularity of their distribution, and destined to contain and maturate the ovules.

The polypidoms, when dried, are for the most part of a yellowish or horn colour. "When they are immersed in water, they recover the same form they appeared in when fresh in the sea; and soon become filled with the liquid. This gives them a semitransparent amber colour, and makes them very elastic." * Their material appears to be analogous to horn or condensed albumen, which is moulded into a homogeneous investing sheath, for the protection of the semifluid pulpous body. It seems to be in fact a sort of hardened epidermis, at first in contact and partial adhesion with the living interior pulp, from which it is subsequently detached, in the natural progress of its consolidation, by a process of shrivelling in the soft matter, and by the motions and efforts of the polypes themselves.† Link says that the experiments he has made on the Plumularia falcata and the Sertularia cupressina have led him to adopt the opinion of Cavolini and Schweigger, that this sheath is vascular and organized, for, under a very powerful magnifier, he has seen coloured vessels ramified in the stem and branches of these polypidoms. He is also certain that their stems are often increased with age by con-

contrary, grow only on these exposures, and never on the south. Sometimes their position is varied according to latitude, and the shores inclined towards the south, in temperate or cold countries, produce the same species as the northern exposures in equatorial regions: in general, their branches appear directed towards the main sea." — Corall. Flex. Introd. p. L.

* Ellis, English Corallines, p. 3.

† See Lister's Observations in Phil. Trans. 1834, p. 374; and Lam. Anim. s. Vert. ii. p. 119. 2de édit.

centric layers, and that the calcareous matter is deposited in true cells.* These observations are intended to support the theory of the independent growth of the polypidom from innate living motions or a vegetative principle; but notwithstanding Link's high authority, and that the more recent observations of Milne Edwards and of Mr. R. Q. Couch may seem to lend it indirectly support, I continue to be of opinion that the theory is untenable. No other micrographist has seen, even in the most transparent species, any trace of a vascular system or of a cellular structure; and, until some organization of the kind can be demonstrated, the polypidom is to be reckoned amongst those products which are usually considered by physiologists as extravascular,† and owe their origin and form to the soft parts in immediate contact with them. It is very true that so long as this contact or relation continues, there is a low degree of life in the extravascular part sufficient to prevent its decay and decomposition, such as is found to be the case in hair, horn, and feathers; but the growth of the two parts is coetaneous, for, although the expansion of the membrane apparently precedes that of the pulp, it is nevertheless dependent on the growth of the latter for its expansion, and regulated by it. "There is," says Professor Grant, "but one life, and one plan of development in the whole mass; and this depends not on the polypi, which are but secondary and often deciduous parts, but on the general fleshy substance of the body."‡

The growth of the polypidom has been accurately observed by many naturalists, and the following seems to be a short

* Ann. des Sciences Nat. Part. Bot. vol. ii. p. 321.—Link himself appears to admit that there was some inaccuracy in his first observations. See Reports on Zoology and Botany, published by the Ray Society, p. 474.

† By *extravascular* we mean a part not permeated by nutritious or absorbent vessels, and undergoing no interstitial change when once formed. M. S. L. Loven, treating of the polypidom, says, "This once produced, is but an inanimate excretion, from every part of which the living portion which made it becomes detached, and does not further nourish it. It is within this protecting envelope that the polyp is developed; that it takes the number, form, and dimensions of all its parts; it then breaks mechanically through its capsule, and is arrested in its growth."—Micros. Journ. i. p. 106.

‡ Outlines of Comp. Anatomy, p. 14.

summary of their observations.* The ripe ovule or bud, discharged from its matrix, settles and fixes itself to the site of its future existence by minute fibres which pullulate from the under-side, while, from the opposite pole, a papillary cone shoots up to a height determined by the law which regulates the peculiar habit of the species. The upward growth is then arrested, and the apex becomes enlarged and bulbous. The structure of this rudimentary shoot is at first apparently homogeneous, but very shortly the separation between the sheath and the interior pulp begins to be defined, and is made hourly more apparent by the pulp retreating inwards, becoming darker and more concentrated. That portion of it in the bulbous top of the shoot goes on to further condensation and development ; and as it enlarges, so in proportion does the horny cuticle that covers it expand apace until it has gradually evolved into one or two cells, which are still closed on all sides. The dark body of the polype is apparent through the thin and transparent parietes, and from its superior disk there are now to be seen some minute tubercles or knobs protruding, which, becoming insensibly but steadily more elongated, constitute the tentacula of the polype,—now nearly ready for a more active life. By an extension of development, or by a process of absorption not well understood, the top of the cell is at length opened, the polype displays its organs abroad, and begins the capture of its prey, for, unlike higher organisms, it is, at this the period of its birth, as large and as perfect as it ever is at any subsequent period, the walls of the cell having become indurated and unyielding, and setting a limit to any further increase in bulk. The growth being thus hindered in that direction, the pulp, incessantly increased by new supplies of nutriment from the polype, is constrained and forced into its original direction, so that the extremities of the tube, which have remained soft and pliant, are pushed onwards, the downward shoot becoming a root-like fibre, and the upper continuing the polypidom, and swelling out as before, at stated intervals, into cells for the new development of other polypes.

* See Couch, Corn. Fauna, iii. p. 7 ; Zoologist, i. p. 206-7 ; Ann. Nat. Hist. xv. p. 163.

The polypes (fig. 2, *c*) are placed in the side and terminal cells within which, with the exception of the Tubularinæ, they can hide themselves entirely when danger threatens. The body is normally of a somewhat globular figure, and of a nearly homogeneous composition, consisting of an aggregation of vesicular granules held together by a semitransparent glairy gelatine. It is very remarkably contractile at every point, so that its form can be changed rapidly from a globe to a cylinder, or distorted with swellings and constrictions ; and the tentacula, endowed equally with this contractile power, can be also shortened and extended at will, and sometimes to an extent which is almost marvellous.* When therefore the polypes have occasion to conceal themselves within their cells, they are not necessitated to bend the body in order to obtain sufficient space, but they shorten the body and the tentacula at the same time by a process of condensation, causing the one to assume a more globular form, and the other to dwindle down to mere knobs or papillæ.

The tentacula are irregular in number. They are always simple and filiform, or rather tapered a little towards the extremity, and have their surface roughened more or less with granules arranged in an imperfectly verticillate fashion. The granules appear to be of a glandular nature; but in the Hydra, and perhaps in some others, they are also organs which contain a singular apparatus to paralyse and kill the animalcules the polype feeds upon.

In the centre of the circle formed by the tentacula, on the superior disk of the body, is placed the oral aperture, very dilatable and sometimes capable of being elongated into a sort of snout, but which is always unfurnished with any ciliary or dental apparatus. It leads by a short passage into the stomach, which is not a distinct sac, but a simple cavity ex-

* This extensible capacity has been usually ascribed to an expansion and wider separation of the vesicular granules of the organs, and their contractility to the condensation of the same granules ; but it would appear that the motions may be partly ascribed to a muscular structure. Mr. Lister says, that, "in the substance of the necks of the polypi (of Sertularia pumila), transverse lines were visible, bearing a resemblance to those characteristic of voluntary muscles in the higher animals."—Phil. Trans. 1834, p. 371. Corda has described and delineated muscular bands in the tentacula of the Hydra ; and M. Quatrefages, a regular muscular system in his Synhydra.—Ann. des Sc. Nat. xx. p. 238.

cavated as it were in the body, "neither figured nor limited by particular membranes," and from which the indigestible remains of the food are ejected at the same aperture by which it had entered. The part of the body underneath the stomach offers no peculiarity in structure, and although it rests upon a sort of diaphragm in the cell, it is nevertheless continuous with the more fluid pulp that fills the branches and stem of the polypidom; and by this means all the polypes of it are connected together by a living thread, and made to constitute a family whose objects and interests are identical, and whose workings are all regulated by one harmonious instinct. This organic connection and harmony between the individuals has led Linnæus and Cuvier to regard the whole composure as one animal furnished with a multitude of armed heads and mouths; and it would have been difficult to controvert the opinion, had our knowledge been limited to those species only which ramify after the manner of a tree: but the contrary view which we have taken is supported by the evidence of those species which are simple and separate of themselves, and of those others which, although compound, have yet a defined and limited digestive organ, as is the case in the genera Coryne and Hydractinia.*

In these simple animals there is no nervous system,† and no organ of sense in the adult; no organ exclusively appropriated to the function of respiration, no circulatory system, nor any vessels for carrying the digested products of the stomach into and throughout the body. All seem to be confused and combined; and the water in which the polypes live, in its flow over the external surfaces, and in its penetration into the stomachal cavity, suffices to impart the oxygen necessary to complete the assimilation of the nutritive liquid, that oozes from its source directly into the parenchyma of the body with which it enters into combination. There is, however, a kind of circulation in the species with a polypidom,

* Van Beneden, Recher. des Tubulaires, p. 19.

† "But as we perceive, in these animals, phenomena which take place by the medium of nerves in animals of a more elevated order, that is to say, sensibility and voluntary motion, it is not improbable that in them the nervous substance is mixed with their gelatinous or mucous mass, without being demonstrable as a particular tissue."—Tiedemann's Comp. Phys. p. 64. See also Macleay's Hor. Ent. p. 196.

which, while it may remind us of the circulation in higher animals, has yet but little affinity with it; and, according to Van Beneden, as little with the circulation observable in the stems of the Chara, with which it had been compared, for it is not carried on in a closed tube or vessel.* The circulation in question is that of a granulous fluid in the fistular stem of the polypidom, and through every branch of it, and which penetrates within the body and stomach of the polypes themselves. Cavolini discovered it first in the Sertulariæ; and soon after, in 1786, the celebrated Spallanzani observed the same phenomenon, which he has described with great particularity.† Müller likewise noticed it in 1789, but mistook the moving granules for infusory animalcules. (Zool. Dan. iii. p. 62.) Very recently the attention of naturalists was more drawn towards the function by the observations of Mr. Lister, who ascertained its existence in the Tubulariæ, and in almost all the genera of the order; and subsequent researches have done little beyond confirming what Mr. Lister has so well described.

* Mém. sur les Campanulaires, p. 17.

† As Spallanzani's observations have been overlooked, I shall insert here his account of them entire. He made the discovery in 1786, and the truth of it he confirmed, during his travels in the Two Sicilies, by new observations on a species of Campanularia allied to C. volubilis. "Along the foot or stem," he says, "of every polypus we see a small column or chain of particles which extend upwards to the extremity of the bell. At first, I thought that these atoms made a part of the organization of the animal; but I afterwards found that they were not fixed but moveable, and designed for the same function with the red globules of the blood in animals of a superior order. The following is the method adopted by nature in the motion of these minute particles. Every five or six minutes they ascended rapidly from the bottom of the stem, and penetrated longitudinally through the middle of the bell. In the mean time, the number of them in the stem diminished, until, at length, very few remained there, the greater number having passed into the bell; where they were all in motion, producing a kind of effervescence, which continued some seconds. They afterwards returned, by the way they had ascended, to the lower extremity of the stem, where they remained at rest for a short interval; and during this interval it was that I first saw them, and took them for a solid part of the animal. They soon, however, resumed their former motion, ascending through the stem, and collecting in the bell; where the intestine ebullition again took place, till the current again descended to the bottom of the stem, when the same alternation of rest and motion succeeded. Thus the mass of these particles moved regularly and constantly in the polypi, which it could not have done, unless we suppose a canal or longitudinal vessel, though the transparency of the polypi prevented its cavity being discernible." —Travels in the Two Sicilies, iv. p. 287-9.

The circulating fluid is loaded with minute granules of nearly equal volume and shape, and endowed with a proper mobility. It moves within the tubular divisions of the polypidom, ascending on one side of the tube and descending on the other, or ascending and descending in a canal in the centre of the living pulp. It has no central point to start from, and no fixed goal to reach before it commences its return; neither is it always steady nor constant in its course, for the stream may be seen to vary in velocity, to stop at uncertain intervals, to retrograde on the line it had advanced upon, and to exhibit other partial irregularities without any obvious cause. In its usual course the fluid flows on uninterruptedly up the stem until it meets with a knot or branch, when it is thrown into a slight eddy, or divides itself to follow up the ramifications of the polypidom; and when the limit has been reached, either just below the base of the polype, or in the very stomach of the creature, the granules turn round and pass over to the other side to run their reversed course. "If the currents be designedly obstructed in any part of the stem, those in the branches go on without interruption, and independently of the rest. The most remarkable circumstance attending these streams of fluid is, that they appear to traverse the cavity of the stomach itself, flowing from the axis of the stem into that organ, and returning into the stem, without any visible cause determining these movements." *

The power which sets in motion and maintains this current is yet undiscovered. Spallanzani suggested that it might be owing to the elasticity of the sides of the cell and of the stalk acting upon a fluid by which they had been for a time over-distended; "but this hypothesis," he himself adds, "is not only unsupported by proofs, but insufficient to explain the phenomena."† The fact is, that the parietes of the tube and of the cells are not elastic in that direction. Professor Grant asserts that it depends on the action of minute vibratile cilia, —"the common agents of all analogous movements in the

* Roget's Bridgew. Treat. vol. ii. p. 233. See also Tiedemann's Comp. Physiol. p. 150. Ent. Mag. vol. iii. p. 174. Grant's Outlines of Comp. Anat. p. 429–30. Van Beneden, Mém. sur les Campanulaires, p. 17, 18; and his Rech. sur les Tubulaires, p. 20.

† Travels, iv. p. 292.

lowest tribe of animals;"*—but no direct observation has confirmed this explanation, which, it will be observed, is founded on analogy only; and it has this in opposition—that the non-existence of cilia in the external organs of the zoophytes in question has been distinctly proved. As to the purpose of the circulation in the animal's economy, it appears, from the experiments of Mr. Lister, "to be the great agent in *absorption*, and to perform a prominent part in the obscure processes of growth; and its flow into the stomach of the polypi seems to indicate that in the very simple structure of this family it acts also as a solvent of the food.—The particles carried by it," continues Mr. Lister, "present an analogy to those of the blood in the higher animals on one side, and of the sap of vegetables on the other. Some of them appear to be derived from the digested food, and others from the melting down of parts absorbed; but it would be highly interesting to ascertain distinctly how they are produced, and what is the office they perform, as well as the true character of their remarkable activity and seemingly spontaneous motions; for the hypothesis of their individual vitality is too startling to be adopted without good evidence."†

It had been so long agreed that there were no sexes amongst the Hydroid zoophytes that naturalists were rather startled when Ehrenberg announced the contrary to be the fact. This celebrated micrographist asserts that in the Hydra there is a periodical development of sexual organs of two kinds,—small sacs to wit at the oral extremity, which contain seminal animalcules, and a series of cells at the posterior part of the body in which the ova are produced. The animal is consequently hermaphroditical, but "sometimes one individual Hydra develops only the male cysts, or sperm-vesicles; sometimes only the female ones, or ovi-sacs."‡ Ehrenberg extended this view to other polypes: the individuals in the permanent cells of the Sertulariadæ were considered to be sterile or male, while the almost amorphous or imperfectly developed individuals in the deciduous vesicles, which appear at certain

* Outlines of Comp. Anat. p 430.

† Phil. Trans. 1834, p. 377.

‡ Owen's Lectures, p. 85; Lancet, No. 871, p. 225.

seasons only, were believed to be the fruitful females.* Observations to fortify these novel views have been published by several naturalists, and they have been adopted with ardent zeal by M. Loven. He found that in the Coryne the sexes were marked by outward characters, the females having no tentacula ;† an observation which has been confirmed by Quatrefages and Van Beneden, who add that, in an allied genus, the oviferous individuals are without any oral aperture.‡ These, and other observations to the same purport, are correct; but, as Van Beneden appears to us to have proved, they have been misinterpreted, and will not support the conclusion that has been deduced from them. The seminal animalcules detected in some species are granular bodies connected with the circulation ;§ and the misnamed females which have been described as pullulating from the body of another polype, or nestling in the ovarian vesicles, are young polypes incompletely developed, but which contain ova or buds before they have attained their full growth.‖ It is a disregard of the fact that the young can develop ova that has led to this sexual theory, which, with Van Beneden, we consider to be erroneous; but at the same time it is not to be denied that, in almost every cluster of every species, some individuals will be observed to be barren while others are loaded with gemmules or ovigerous vesicles, and in the latter, the tentacula of the polypes, or the branches of the polypidom, are occasionally more or less defective and atrophied.

This order of zoophytes is propagated by buds or gemmules and by eggs. By the former the polype extends its individual

* I have not seen any work of Ehrenberg's in which this view is given, but I have gathered my statement of it from other works. In the "Corallenthiere des rothen Meeres," published in 1834, Ehrenberg says of these zoophytes : "Androgyna, nunquam sexu discreta ; interdum alia unius speciei individua semper sterilia, alia ovipara (*Hydrae*, *Corynae*, al.), apparatu femineo valde distincto, masculo nondum reperto." p. 31.

† Microscopic Journal, i. p. 107.

‡ Quatrefages in Ann. des Sc. Nat. xx. p. 233.—Van Beneden sur les Tubulaires, p. 63. Ann. Nat. Hist. xv. p. 248.

§ Van Beneden sur les Tubulaires, p. 28–9, and p. 33 ; sur le sexe des Anodontes, p. 7, 8.

‖ Sur les Tubulaires, p. 25. Also Ann. Nat. Hist. xv. p. 245.

life, while by the latter the species is multiplied and continued.

The bud is a shoot merely from the pulpous axis of the polypidom, or from the body of the naked species, and is identical in structure with the part of the parent whence it pullulates. Every species begins its existence with a single polype, which, by the evolution of a succession of buds, after an order peculiar to each, grows up to a polypidom that may contain many hundreds of tenants. On the regulated production of these buds the upward growth and character of the polypidom depends; and simultaneous with its growth, the fibres by which it is rooted extend and increase themselves, and, at uncertain intervals, give existence to similar buds, whence new polypiferous shoots take their origin, for these root-fibres are full of the same living medullary substance with the rest of the body. To use the words of Ellis,—"These tubes not only secure it from the motion of the waves, but likewise from these rise other young animals or corallines, which growing up like the former, with their proper heads or organs to procure food, send out other adhering tubes from below, with a further increase of these many-headed branched animals; so that in a short time a whole grove of vesicular corallines is formed, as we find them on oysters, and other shell-fish, when we drag for them in deep water."*

> "New buds and bulbs the living fibre shoots
> On lengthening branches, and protruding roots;
> Or on the father's side from bursting glands
> The adhering young its nascent form expands;
> In branching lines the parent trunk adorns,
> And parts ere long like plumage, hairs, or horns."†

In the fresh-water Hydræ the bud bourgeons apparently from any point of the body, evolves, gradually assumes the port and aspect of the parent, and then, by a natural process of atrophy, detaches itself and goes away to act its part independently amongst the entities of nature.

The eggs or ovules by which the species is continued are of several kinds. The first we shall notice have been called

* Ellis and Solander's Zoophytes, p. 33.

† Darwin, Temple of Nature, canto ii.

by Van Beneden free or motive buds, because, although produced in ovisacs, they are but a prolongation or extension of the common pulp of the parent polype. They are produced by all the Tubularinæ from the little coloured bulbs or grape-like clusters which, at fit seasons, pullulate from the bases of the tentacula; and they are also produced by the Campanulariadæ in their ovarian vesicles. It has not been ascertained that any other zoophyte produces them.

The changes which these motive buds suffer in their development are amongst the most remarkable of the secrets of the deep waters that naturalists have unveiled. Sir John Graham Dalyell was the first to lift the curtain; and although I am not in a position that enables me to chronicle the observations of others on this point, yet it may safely be said that for the full knowledge of the secret we are indebted to Professor Van Beneden of Louvain. In detailing some experiments on Tubularia indivisa, Sir J. G. Dalyell tells us, that, so soon as the bud has fallen from its crested head, slight prominences, enlarged at the tips, pullulate from the under surface, and the "nascent animal," elevating itself on these rudiments of the tentacula, as on so many feet, enjoys the faculty of locomotion. "Apparently selecting a site, it reverses itself to the natural position with the tentacula upwards, and is then rooted permanently by a prominence, which is the incipient stalk, originating from the under part of the head. Gradual elongation of the stalk afterwards continues to raise the head, and the formation of the zoophyte is perfected."* Again, in his account of Laomedea dichotoma, Sir John informs us that it rarely produces vesicles. When present, they contain from twenty to thirty greyish corpuscula with a dark central nucleus. "At first, all are immature and quiescent, but motion at length commences: the corpuscula become more distinct; several slender arms protrude from the orifice of the vesicle, which are seen in vehement action, and, after many struggles, an animated being escapes. But this has no relation either to the *planula* of the Sertulariæ, or the corpusculum of the Flustra, Alcyonium, or Actinia. It might be rather associated with the Medusariæ. Before ascertaining

* Edin. New Phil. Journ. xvii. p. 412.

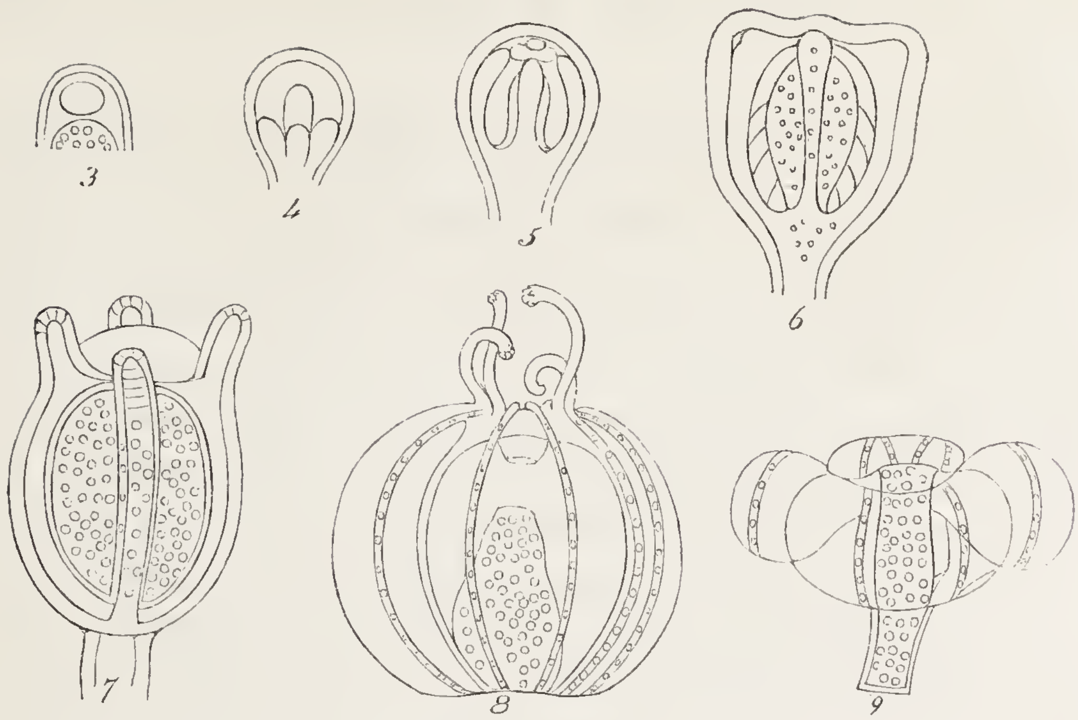
its origin, I had named it *Animalculum tintinnabulum*, from its general resemblance to a common hand-bell, for the purpose of recognition. This creature is whitish, tending to transparency, about half a line in diameter; the body is like a deep watch-glass, surmounted by a crest rising from the centre, and fringed by about twenty-three tentacula pendant from the lip below. These are of muricate structure, or rough, and connected to the lip by a bulb twice their own diameter. The summit of the crest unfolds occasionally into four leaves, and four organs, prominent on the convexity of the body, appear at its base. When free, the animal swims by jerks, or leaps through the water, or drops gently downwards; it is invited to move by the light, and it has survived at least eight days. Then it disappears; at least, I have not been able to pursue its history longer. No other product has ever issued from the vesicles of the Sertularia dichotoma."*

This metamorphosis, in the same or nearly allied species, has been traced with the hand of a master in anatomy and physiology, by Van Beneden, but it suffices for our purpose to state that his observations establish those of the Scottish naturalist. Originating in the pulp of the parent, the germinating bulb goes through a series of changes. At first it is vesicular and amorphous, but we soon perceive, from little knobs pullulating from the upper disk, and from the body becoming more isolated, a faint portraiture of the future polype in the ovisac or vesicle, whence this embryo is about to issue under the guise of a minute Medusa, to float at freedom in the circumfluent waters. These changes will be easily understood by a selection from the figures given by Van Beneden. (Fig. 3—9.) What is very remarkable in these embryos, is the existence of an organ at the base of each tentaculum, in which appear to be united the sense both of sight and hearing, for it has the same structure as the eye and the ear in the lower tribes of invertebrated animals;† and, moreover, there are found in these embryos distinct bundles of muscles, and nerves with their ganglions,—all of which disappear in the adult. We

* Edin. New Phil. Journ. xxi. p. 91–2.

† Les Campanulaires, p. 26–7.—The medusan embryos of the Tubulariæ have not these organs. Les Tubulaires, p. 35.

Fig. 3.



stay not to inquire how this fact quadrates with the "law of development" which has of late been advocated with more speciousness than knowledge; but we must needs breathe a little, while we contemplate this diversion in the plan of creation,—this retrograde step in life,—not unexampled in others of these lower organisms. The young is a nomade creature free to go whither it will, and hence its higher organization—senses to guide, and muscles to move the body to and fro. So alike indeed are they both in form and manners to the Medusæ, that they have been described as members of the latter class by experienced naturalists; and it is not until they have put away the vagrancy and liveliness of youth, that they become staid and fall down into an inferior order. Even in their Medusa stage these embryos often contain ovules whence other young are to proceed.

But the Tubularinæ are also propagated by ovules, which undergo in their development no change that amounts to a metamorphosis. These originate in the same ovisacs as the others, and commence their growth in the same manner; but at an early stage they become separate from the pulp whence they have proceeded, and the process of organization goes on in isolated germs, as in higher animals. The development here is gradual and regular. At the time of its extrusion from the ovisac, this ovule has attained to somewhat the

resemblance of the common Hydra, which settles, roots itself, and glides insensibly into the resemblance of its parent species.

There is still another mode of propagation amongst these zoophytes, viz. by ciliated ovules. These are produced by all those genera which have external ovarian vesicles, and by some naked species. They proceed as usual from the common pulp or fleshy axis, and are matured in the vesicles, which fall off on their discharge. But the maturation seems to be in two degrees. First, the ovules, after they have become distinct and separate from the central pulp in the vesicle, and after they have obtained a self-rotatory motion, are observed to lose their sphericity on approaching maturity; their shape alters, "it elongates, becomes elliptical, next prismatic, and at length each corpusculum issues as a perfect animal from the orifice of the vesicle," and exhibits in figure and in motion much resemblance to the little leech-like Planariæ;—hence this ovule was called a *planule* by Sir J. G. Dalyell. Secondly, the ovules are discharged in their oviform condition and clothed with vibratile cilia. So soon as at liberty, these move and swim in the water as if they were guided by volition and sense, whirling at the same time on their axis, and stopping occasionally as if in search of a situation on which to fix.* This freedom to move whither they list may continue for several hours, or even for two or three days, before a proper site for their permanent stay and future growth is found, when they begin to shoot up rapidly into those beautiful forms particular to each species, as the Supreme Being has ordered and determined. The transformation of the ova, says Dr. Grant, "from their moving, irritable, and free condition of animalcules to that of fixed and almost inert zoophytes, exhibits a new metamorphosis in the animal kingdom, not less remarkable than that of many reptiles from their first aquatic condition, or that of insects from their larva state." One purpose of this mobility in the ova is obvious:—it is a means ordained for their diffusion, for, the parents being fixed immovably to one spot, the reproductive germs would have dropt and sprung up at their roots, had they not, by some

* See Couch in Ann. N. Hist. xv. p. 162; Corn. Fauna, iii. p. 5.

such mechanism as we have described, been carried to a distance, and spread over the bosom of the deep.

There are many facts which prove that the growth of these polypidoms is very rapid, but not more so than might be anticipated when it is remembered how vast is the number of polype architects; and no sooner is a new branch extended than it becomes almost simultaneously a support of new workers, which, with "toil unweariable," add incessantly to the materials of increase.* Their duration is various: some have only a summer's existence, as Laomedea geniculata; many are probably annual; and the epiphyllous kinds cannot at most prolong their term beyond that of the weed on which they grow: but such as attach themselves to rocks are probably less perishable, for their size and consistency seem to indicate a greater age: it is thus with the Tubulariæ and some of the compound Sertulariadæ.†

* "In the S. polyzonias, I have some reason to believe that a large specimen can be formed, under favourable circumstances, in the course of fourteen days."—Couch, Corn. Faun. iii. p. 8.

† Couch, Corn. Faun. iii. p. 9.—That the polypidoms of the Hydroid Zoophytes perish soon after attaining their full size, is rendered probable by the fact of their being cast ashore, some at one season and some at another, independent of storms or any cause that could tear them away from their attachments. As an illustration, I give in this note some facts of the kind communicated to me by Miss Forster, who made the observations at Tynemouth, Northumberland, from the middle of July until the end of November, 1839.

Tubularia indivisa—thrown on shore plentifully in August; occasionally in September, October, and November.

Tubularia Larynx—the finest specimens in August, but found afterwards.

Tubularia ramea—common in August and September.

Thoa halecina—one very fine specimen, crowded with vesicles, in July; inferior specimens with vesicles in August, and very poor pieces afterwards.

Thoa muricata—plentiful in November, crowded with vesicles.

Sertularia polyzonias—in August specimens found on the shore were about half an inch high, but two dredged from deep water were about two inches: in November pieces found on the shore were from two to fully three inches high. Vesicles, sparingly produced, were found in August and November.

Sertularia rugosa—vesicles plentiful in July and August; very fine, but without vesicles in October and November.

Sertularia rosacea—vesicles in July, August, September, and November.

Sertularia pumila—vesicles in August and September.

Sertularia pinnata—in August this species was dredged up from deep water, but it was not found on the shore until November, when the specimens were much larger: no vesicles at either time.

Sertularia tamarisca—only one small piece, with two vesicles, in July.

But the life of the polypes considered abstractedly is probably in no instance coetaneous with the duration of the polypidom, for the lower parts of this become, after a time, empty of pulp and lifeless, and lose the cells inhabited by the polypes, which, in an old specimen, are to be found in a state of activity only near the summit, or on the new shoots. The Thuiaria thuja affords a remarkable example of this fact; the branches which carry the polypes dropping off in regular succession as younger ones are formed, so that the polypidom retains, throughout its whole growth, the appearance of a bottle-brush, the naked stem and the branched top being kept in every stage in a due proportion to each other.

Sertularia abietina—very common in July, and again in September, October, and November: vesicles in September, but not plentiful.

Sertularia filicula—very common in July, when one specimen was found with two vesicles: again plentiful in November, but the specimens looked younger, as if of this year's growth, and one piece an inch and a half long was found rooted to a skate's horny case; which case, from its perfect state, must have been deposited this year.

Sertularia operculata—very common; vesicles in July, August, October, and November.

Sertularia argentea—plentiful in September, and occasionally with vesicles, but only young specimens.

Sertularia cupressina—only one, but a very beautiful specimen, loaded with vesicles in August.

Thuiaria thuja—plentiful and very fine in November; vesicles crowded the latter part of November.

Antennularia antennina—dredged from deep water in August, very fine; thrown on the shore from August to November: no vesicles.

Plumularia falcata—very plentiful the whole of autumn; vesicles in July and September, but not plentifully.

Plumularia pinnata—dredged up in August, very fine, above four inches high; vesicles abundant, but not full-grown: three specimens found on the shore in September, denuded of their pinnæ, vesicles abundant: on one specimen they were emptied of their ova, and the apertures had the circle of spinous teeth.

Plumularia setacea—frequent on the roots of the Fucus digitatus, but not more than an inch in height: vesicles in August.

Plumularia frutescens—only one specimen, with one vesicle, in November.

Laomedea dichotoma—one or two poor specimens.

Laomedea geniculata—very common.

Laomedea gelatinosa—small, on stones at low-water mark; but thrown on the shore in July about three inches long.

Campanularia volubilis—common; vesicles in July and August.

Campanularia syringa—rather common, twisting over the roots of Fucus digitatus, and up the stems of Fucus sanguineus and Thuiaria thuja: no vesicles.

Campanularia dumosa—very plentiful and very fine in October and November.

Sertularia argentea, Plumularia falcata, &c. are subjected to the same law,—the primary polypiferous shoots being deciduous, so that in them also the stalk becomes bare, while the upper parts are graced with a luxuriant ramification loaded with tiny architects. But in our eagerness to generalize, let us not forget that there are some species, as Sertularia pumila, abietina, &c. in which this process of successive denudation is not observable,—perhaps, however, because of their form, which is not of a kind to be altered by it, and hence unnoticeable, or because the duration of the whole is too fugitive to permit the law to produce a visible effect.

There are facts which appear to prove that the life of the individual polypes is even more transitory than their own cells; that like a blossom they bud and blow and fall off or are absorbed, when another sprouts up from the medullary pulp to occupy the very cell of its predecessor, and in its turn to give way and be replaced by another. When speaking of flexible corallines Lamouroux says, " Some there are that are entirely covered with polypi through the summer and autumn, but they perish with the cold of winter: no sooner, however, has the sun resumed his revivifying influence than new animals are developed, and fresh branches are produced upon the old ones." * Of the Tubularia indivisa, Sir John G. Dalyell tells us that " the head is deciduous, falling in general soon after recovery from the sea. It is *regenerated at intervals* of from ten days to several weeks, but with the number of external organs successively diminishing, though the stem is always elongated. It seems to rise within this tubular stem from below, and to be dependent on the presence of the internal tenacious matter with which the tube is occupied. A head springs from the remaining stem, cut over very near the root; and a redundance of heads may be obtained from artificial sections, apparently beyond the ordinary provisions of nature. Thus twenty-two heads were produced through the course of 550 days, from the sections of a single stem." † The observations of Mr. Harvey on the same, or a very nearly allied, species of zoophyte confirm the experiments of Sir J. G. Dalyell, so far as these have reference to the deciduousness of

* Corall. Flex. p. xvi.

† Edin. New Phil. Journ. xvii. p. 415.

the polypes and their regeneration ;* and it seems to me not altogether unwarrantable to infer a like temporary existence and revival in those of the Sertulariadæ from a reflection on the experiments of Mr. Lister,—incomplete certainly, but which prove that, unfavourably situated, the polypes disappear by a process of internal absorption,† and would probably have been renovated had fresh water been supplied, as I have witnessed this result in similar experiments. On Saturday, May 28th, 1837, a specimen of Laomedea gelatinosa was procured from the shore, and, after having ascertained that the polypes were active and entire, it was placed in a saucer of sea-water. Here it remained undisturbed until Monday afternoon, when all the polypes had disappeared. Some cells were empty or nearly so ; others were half-filled with the wasted body of the polype, which had lost, however, every vestige of the tentacula. The water had become putrid, and the specimen was therefore removed to another vessel with pure water, and again set aside. On examining it on the Wednesday (June 1st), the cells were evidently filling again, although no tentacula were visibly protruded ; but on the afternoon of Friday (June 3d) every cell had its polype complete, and displayed in the greatest perfection.‡ Had these singular facts been known to Linnæus, how eagerly and effectively would he have impressed them into the support of

* "The most singular circumstance attending the growth of this animal, and which I discovered entirely by accident, remains to be mentioned. After I had kept the clusters in a large bowl for two days, I observed the animals to droop and look unhealthy. On the third day the heads were all thrown off, and lying on the bottom of the vessel ; all the pink colouring matter was deposited in the form of a cloud, and when it had stood quietly for two days, it became a very fine powder. Thinking that the tubes were dead, I was going to throw them away, but I happened to be under the necessity of quitting home for two days, and on my return I found a thin transparent film being protruded from the top of every tube : I then changed the water every day, and in three days' time every tube had a small body reproduced upon it. The only difference that I can discover in the structure of the young from the old heads, consists in the new ones wanting the small red *papillæ*, and in the absence of all colour in the animal."—Proceed Zool Soc. No. 41, p. 55.

† Phil. Trans. 1834, p. 374, 376.

‡ See also Couch's Corn. Fauna, iii. p. 2.—I have now ascertained that the heads of Coryne pusilla, although apparently continuous with the apices of the branches, are deciduous like those of the Tubulariæ, and produced anew in favourable circumstances.

his favourite theory! Like the flowers of the field, the heads or "flores" of these polypidoms expand their petaloid arms, which after a time fall like blighted blossoms off a tree;—they do become "old in their youth," and rendered hebetous and unfit for duty or ornament by age or accident, the common trunk throws them off, and supplies its wants by ever-young and vigorous growths. The phenomena are of those which justly challenge admiration and excuse a sober scepticism, so alien are they to all we are accustomed to observe in more familiar organisms; but, besides that faithful observation renders the facts undeniable, a reflection on the history of the Hydra might almost have led us to anticipate such events in the life of these zoophytes. "Verily for mine owne part, the more I looke into Nature's workes, the sooner am I induced to beleeve of her even those things that seem incredible."

It has been observed that many of the Hydroid Zoophytes emit a luminous or phosphorescent fluid; but whether this is a secretion of health and life, or the result of some partial decay and decomposition, cannot be said to have been ascertained:—perhaps the facts lead us rather to favour the latter supposition.* No species has been seen luminous in its natal site and when undisturbed; but after being torn from their attachments, or tossed ashore and trodden upon, or carried away to the home of the experimenter and variously irritated, then the tiny lamps shine forth momentarily, die away again, and are not relit unless some new shock or injury is given. The facts are interesting enough to be given in detail.

* Mr. Hassall thinks it dependent on vitality, and that loss of vitality destroys the phosphorescent emission (Ann. and Mag. Nat. Hist. viii. p. 343); but certainly his observations do not prove this. [On this passage Mr. W. Thompson has favoured me with the following note: "I do not think it probable that the luminosity of Zoophytes is caused by 'partial decay and decomposition,' as I have, especially in the month of January, 1834, and frequently since, observed many species to put forth their lights vigorously a very few hours—certainly within three—after I had dredged them from the bottom of the sea. They were not sooner looked at, as it was not dark until about that time after their capture. 'Torn from their attachments' these certainly were, but they were treated tenderly, and placed in a huge vasculum or botanical box, and in it conveyed to our quarters. The Zoophytes parasitic on algæ, brought home in the same way, made their positions known by exhibiting their tender and beautiful lights."] Mr. Thompson has seen Chondrus crispus, Cystoceira ericoides, and other algæ, luminous in a growing state.—See Ann. Nat. Hist. viii. p. 216.

Mr. Stewart, whose work was published in 1802, tells us that *Sertularia pumila*, "and probably many others, in some particular states of the atmosphere, give out a phosphoric light in the dark." If, he continues, a leaf of the Fucus serratus "with the Sertularia upon it, receive a smart stroke with a stick in the dark, the whole coralline is most beautifully illuminated, every denticle seeming to be on fire."*—Crabbe appears to have witnessed the same phenomenon, for the particularity of his description of it argues a personal knowledge;† and my friend Dr. Neill, shortly after the publication of the first edition of this History, wrote to inform me that he had long been familiar with the fact. It was remarked by Mr. Hassall, in 1840, to be more general than these records would have warranted us to conclude, for he says that he had then ascertained "that *all* the more transparent zoophytes possess highly luminous properties. This fact," Mr. Hassall continues, "I first discovered in a specimen of *Laomedea gelatinosa*, and subsequently in a great variety of other species. If a portion of it, adhering to the sea-weed to which it is attached, be taken from the water and agitated, a great number of bright phosphorescent sparks will be emitted; these sparks proceed from each of the denticles of the coralline containing polypi, and the phenomenon is equally apparent, whether the specimen be in or out of water." "I lately had an opportunity of beholding this novel and interesting sight of the phosphorescence of zoophytes to great advantage, when on board one of the Devonshire trawling-boats which frequent this coast. The trawl was raised at midnight, and great quantities of corallines were entangled in the meshes of the network, all shining like myriads of the

* Elem. Nat. Hist. ii. p. 441.

† "While thus with pleasing wonder you inspect
Treasures the vulgar in their scorn reject,
See as they float along th' entangled weeds,
Slowly approach, upborne on bladdery beads;
Wait till they land, and you shall then behold
The fiery sparks those tangled fronds infold,
Myriads of living points; th'unaided eye
Can but the fire, and not the form, descry."

The Borough. Letter ix.

brightest diamonds."* These interesting observations were soon afterwards confirmed by others of a similar nature made by the Rev. D. Landsborough. He found the *Sertularia polyzonias* and *Plumularia cristata* to give out little light, perhaps from some unfavourable condition of the specimens; but the *Laomedea geniculata* "was very luminous, every cell for a few moments becoming a star; and as each polype had a will of its own, they lighted and extinguished their little lamps, not simultaneously, but with rapid irregularity, so that this running fire had a very lively appearance." In another experiment with the same species, and when in all probability the polypes were dead, bright sparks were elicited on roughly handling the polypidoms, which also "emitted a strong smell of phosphorus."† After being dried or wasted by exposure to the air or rain, or by putrefaction, these zoophytes give no further evidence of the existence of an excretion which appears given to them as a means of fraying away their enemies, for it is never made visible to us, unless under circumstances that imply a feeling of injury and alarm.

* Ann. and Mag. Nat. Hist. vii. p. 281.—I add another passage from a subsequent paper of Mr. Hassall's in vol. viii. p. 342, of the same journal:—"Numerous friends, among others G. J. Allman, Esq., of Bandon, can bear witness to the exceeding brilliancy of the phosphorescent light emitted by a great variety of species which I was frequently in the habit of exhibiting to them. Once each week I received from the master of a trawling-vessel on the Dublin coast a large hamper of zoophytes in a recent state; in the evening these were taken into a darkened room, and the spectators assembled; I then used to gather up with my hands as much of the contents of the hamper as I could manage, and, tossing them about in all directions, thousands of little stars shone out brightly from the obscurity, exhibiting a spectacle, the beauty of which to be appreciated must be seen, and one which it has been the lot of but few persons as yet to have looked upon. Entangled among the corallines were also numerous minute luminous Annelides, which added their tiny fires to the general exhibition."

† Ann. and Mag. Nat. Hist. viii. p. 258-9.—The priority in discovery of phosphorescence in Hydroid Zoophytes has given rise to some discussion between Prof. Forbes and Mr. Hassall. See Ann. Nat. Hist. xii. p. 118-120; and p. 42, comp. with p. 189-90.

I arrange the British species of this order under the following tribes, families, and genera:—

* Ovisacs or bulbules naked, bud-like, pullulating from the bases of the tentacula. TUBULARINA, Ehrenberg. (Tubularia, *Linnæus*. Tubulariadæ, *Johnston*. Les Tubulaires, *Van Beneden*.)

Family I.—Polypes naked, or with only a rudimentary polypidom. *CORYNIDÆ.*

† Polypes naked

The tentacula scattered.	CLAVA.
The tentacula in one row.	HYDRACTINIA.

† † Polypes with a horny cuticle

The tentacula with globose tips.	CORYNE.
The tentacula filiform.	CORDYLOPHORA.

Family II.—Polypidom fistular: the tentacula whorled. *TUBULARIADÆ.*

† The tentacula in a single whorl.	EUDENDRIUM.

† † The tentacula in a double whorl

Polypidom rooted.	TUBULARIA.
Polypidom unrooted and deciduous.	CORYMORPHA.

* * Ovisacs in the form of horny capsules or vesicles scattered on the polypidoms and deciduous. SERTULARINA, Ehrenberg. (Sertularia, *Linnæus*.)

Family III.—Cells of the polypes sessile. *SERTULARIADÆ.*

† Cells biserial

Cells alternate, tubular.	HALECIUM.
Cells vasiform, everted.	SERTULARIA.
Cells conico-tubular, appressed.	THUIARIA.

† † Cells uniserial

The branchlets plumose or pectinate.	PLUMULARIA.
The branchlets whorled.	ANTENNULARIA.

Family IV.—Polype-cells on ringed stalks. *CAMPANULARIADÆ.*

Cells alternate, campanulate.	LAOMEDEA.
Cells irregular or whorled.	CAMPANULARIA.

* * * Polypes propagating by buds and ova, which develop themselves on and in the body of the parent. HYDRINA, Ehrenberg. (Hydra, *Linnæus*. HYDRAIDÆ, *Johnston*.)

One genus only.	HYDRA.

ANTHOZOA HYDROIDA.

I.—TUBULARINA.

Ehrenberg *Corall. des roth. Meeres*, p. 70.

FAMILY—CORYNIDÆ.

TUBULARIÆ pars, *Pallas* Spic. Zool. fasc. x. p. 36–7. HYDRÆ pars, *Müller* Zool. Dan. prod. p. 230. Genus CORYNE, *Lamarck* Anim. s. Vert. ii. 61. *Fleming* Brit. Anim. 553. *Blainville* Actinolog. 471. *Schweigger* Handb. 409.—Les CORINES, *Cuvier* Reg. Anim. iii. 295.—Family CORYNIDÆ, *Johnston* in Trans. Berw. Club (1836), p. 107. CORYNAIDÆ, *Gray* in Syn. Brit. Mus. (1840), p. 76.

CHARACTER.—*Polypes rooted, fleshy or sheathed in a horny skin, simple or ramous, the upper part dilated into a clavated head armed with tentacula, which are either irregular or sub-biserial, and are variable in number: mouth terminal: oviform capsules pullulating in clusters from the bases of the tentacula and naked.*

1. CLAVA,* Gmelin.

CHARACTER.—*Polypes single, fleshy, more or less club-headed, but contractile and mutable in form; the tentacula scattered, smooth, filiform, varying in number; mouth terminal and naked.*

The genus is thus defined by Gmelin: "Corpus carnosum, gregarium clavatum, pedunculo tereti affixum: apertura unica verticali." It is founded on an animal described, in 1775, by Otto Frederick Müller, in a paper in the "Beschaftigungen der Berlinischen Gesellschaft Naturforschender Freunde," for a transcript of which I am indebted to my friend Dr. W. Baird. The description is written in Müller's usual interesting manner, and is so full that no one can mistake the

* *Clava*, a club. Agassiz gives *Oken* as the author of the genus.

zoophyte he had in view. Could there have been a doubt, it is removed by Müller himself, for he quotes it as identical with the *Coryne squamata* of the Zoologia Danica. But the latter animal is the type of the genus Coryna of Ehrenberg (1834), and of his followers; and hence it is certain that Ehrenberg's *Coryna* and Gmelin's *Clava* are synonymous. The law of priority decides which name is to be preferred.

1. C. multicornis, *rose-coloured, the tentacula filiform and elongate.* P. S. Pallas.*

Plate I. Fig. 1—3.

Polyporum species margine conchæ insidentes, *Bast.* Opusc. Subs. i. 44, tab. 5, fig. 2, *c*.—Zoophyton minutum Coryne simillimum, *Pall.* Spec. Zool. fasc. x. 36, tab. 4, fig. 9, d. d. e. f.—Hydra multicornis, *Forsk.* Desc. Anim. 131, no. 87, tab. 26, b, b., copied in Encyclop. Method. pl. 69, fig. 12, 13.—Molluscum, *Müller* in Beschaft. der Berlin. Gesell. Nat. 400, tab. 5, fig. 3, 4.—Hydra squamata, *Müll.* Zool. Dan. prod. 230, no. 2786. Zool. Dan. i. 3, tab. 4, fig. 1—3, copied in Encyclop. Method. pl. 69, fig. 10, 11. *Fabric.* Faun. Groenl. 347.—Clava parasitica, *Turt.* Gmel. iv. 100.—Tubularia affinis, *Turt.* Gmel. iv. 668. *Turt.* Brit. Faun. 210. *Stew.* Elem. ii. 438.—Coryne squamata, *Lam.* Anim. s. Vert. ii. 62: 2de édit. ii. 73. *Jameson* in Wern. Mem. i. 565. *Fleming* in Edin. Phil. Journ. ii. 87. *Flem.* Phil. Zool. ii. 616, tab. 5, fig. 1. *Flem.* Brit. Anim. 553. *Coldstream* in Edin. New Phil. Journ. ix. 234. *Blainv.* Actinolog. 471. *Stark* Elem. ii. 443. *Sars* Bidrag til Söedyrenes naturhistorie, förste hæfte, p. 1. *Johns.* Brit. Zooph. 109, pl. 2, fig. 1—3. *Hassall* in Ann. and Mag. N. Hist. vii. 283. *Macgillivray* in Ibid. ix. 463. *Couch* Zooph. Corn. 2: Corn. Faun. iii. 11, pl. 1, fig. 1. *Van Beneden* Tubul. 60, pl. 5, fig. 1—14. Coryna multicornis, *Ehrenb.* Corall. des roth. Meer. 69. *Lam.* Anim. s. Vert. 2de édit. ii. 74. *Templeton* in Mag. Nat. Hist. ix. 419. *Blainv.* Actinolog. 471.

Hab.—Parasitical on sea-weeds, corallines, and rocks, between tide-marks; and is met with on all parts of our coast, where it was first discovered at Harwich by Pallas.

Polypes in general gregarious, fixed by a narrow disk, from two to six or eight lines in height, clavate or cylindrical with a knobbed head, rose-coloured, smooth, and fleshy: the head or upper part furnished with from five to twenty-five scattered filiform tentacula,

* The name affixed to the specific character is that of the person who, so far as I have been able to ascertain the fact, added the species to the British Fauna.—Peter Simon Pallas, M.D., born at Berlin, Sept. 22, 1741; elected F.R.S. in 1764; died Sept. 8, 1811. See Brewster's Edin. Encyclop. xvi. 278; Clarke's Travels, i. 458, &c.; Pennant's Literary Life, p. 7; but above all Cuvier's Memoir in Edin. New Phil. Journ. iv. p. 211, &c.

which are usually shorter than the body, and not always of equal lengths. In gravid individuals the oviform capsules hang, on a scarcely perceptible pedicle, from the bases of the lower tentacula in several clusters, or, sometimes, in one cluster only: they are naked and fleshy, of a round or elliptical figure, rose-coloured with a darker centre, and large in proportion to the animal.

Towards the roots of the tentacula we can frequently observe a reddish spot, which probably indicates the position of the stomach; and a dusky line prolonged down the centre of the body appears to show that the latter is hollow, the canal being doubtless intestinal. The tentacula are marked with a similar line: unlike those of the Hydra they are smooth, or merely crenulate, but like them they are capable of being shortened and elongated at will, though to a less extent. The form of the body is also varied at pleasure, but all its motions are slow, and indicate a very inferior degree of irritability. The apex projects ordinarily, from amid the tentacula, in the form of a conical snout without any visible aperture; but, as Dr. Coldstream correctly says, "after having been kept in small vessels of sea-water for some hours, without renewal of the water, some of the animals protrude the inner surface of the mouth, so as to present a convex disk, with the tentacula ranged round it."

The young are of the same colour and texture as the parent: at first they resemble little smooth rounded tubercles, which gradually elongate, and soon acquire one, then two, three, or four tentacula, and so on till the number of maturity is completed, for these organs are developed in succession.

Pallas was the first to describe this zoophyte, which, he says, is nearly allied to the *Coryne* of Gaertner; and it ought, in his opinion, to be placed, along with the Coryne, in the genus *Tubularia*. "Etiam hæc Tubulariis adnumerari debent Zoophyta, quamvis ne quidem ramescent ut Coryne, et tubulo corneo plane destituta sint. Suadet hoc analoga capitulorum structura in Tubularia, quam *rameam* vocavi (Elench. Zooph. No. 40), et ibi jam polypis racemiformibus in siccato specimine instructam apparuisse monui. Accepi eandem postea recentem et polypos ejus seu capitula intra tubum, angusto collo adtenuatum, retrahi non posse, eodemque modo ac Coryne et affines alii Zoophytum, circa basin ova creberrima proferre. Unde extendendum esse Tubularium characterem genericum, olim exhibitum, apparet."—Forskal next gave a good description and figure of the animal, which he considered to be a marine *Hydra;* and, about the same time, it was characterized as a species of the

same genus by Müller, who, at a subsequent period, figured and described it with an elegance and accuracy which almost defies competition. It seems to have been a favourite with him : "Animalium, quæ Zoophyta dicuntur, nullum elegantius, observatorique magis gratum esse potest." There can be no doubt, however, that the opinion of Pallas, in regard of its affinities, is more correct than that of Forskal and Müller ; and had the present fashion of subdividing natural families into genera on characters of secondary value been then in vogue, undoubtedly the easy task of distinguishing, by a name, this naked zoophyte from the sheathed Tubularia would not have been left to any of his successors.

2. Hydractinia,* Van Beneden.

Character.—*Polypes naked, gregarious, united on a common crustaceous base ; tentacula in one subalternating circle ; eggs or bulbules sessile, clustered, on untentaculated individuals.*

According to Van Beneden, this genus is synonymous with the *Dysmorphosa* of Philippi, the *Synhydra* of Quatrefages, the *Cordylophora* of Allman, and the *Echinochorium* of Hassall. (Ann. Nat. Hist. xv. p. 248 ; Bull. de l'Acad. Roy. de Brux. xii. No. 2.) In referring Cordylophora to it, Van Beneden is obviously wrong, as he himself seems latterly to have suspected. (Bull. sup. cit. p. 14.) Of the sameness of Synhydra with Echinochorium there can be no doubt ; but Mons. de Quatrefages maintains that the genus Synhydra is not only different from Hydractinia, but from all the genera with which Van Beneden has associated it. After an attentive perusal of the friendly discussion which has passed between these naturalists, the correctness of Van Beneden's conclusions appears to me to have been proved. Whether the name Hydractinia or Echinochorium has the prior claim for adoption I cannot ascertain positively. Both were published in 1841. I have preferred the nomenclature of Van Beneden,

* A compound of *Hydra* and *Actinia*. The character given to the genus by Van Beneden is : "Polypes nus ; les tentacules formant un seul verticille ; les œufs sessiles en grappe, situés à la hauteur des tentacules. Tous les individus voisins sont unis entre eux et forment une couche. Point de polypier."—Rech. sur l'Embryog. des Tubulaires, p. 62.

because he discovered the genus early in 1839, while Mr. Hassall did not define Echinochorium until November, 1840.

The polypes in Hydractinia are gregarious or clustered, originating from a horny crust that spreads over the foreign body to which they affix themselves. This character is undoubtedly the principal one that distinguishes the genus from Clava. The tentacula, although in a single whorl, make an approach to become biserial, for every alternate one stands forward a little, and is longer than the one exterior to it. They are contractile, and vary in number according to the age of the individual. It is a singular fact, that, in the species observed by Van Beneden, the oviparous individuals had no tentacula, which apparently had dwindled away from atrophy when the polype began to direct its nutritive power to the development of reproductive germs.

This peculiarity in the oviparous individuals has been also remarked by M. de Quatrefages, who adds, that they are smaller than the others, and destitute of an oral aperture. (Ann. des Sc. Nat. xx. p. 233, 242). He therefore concludes that they receive their nourishment from the barren polypes, for, according to him, there is, underneath the horny base, a network of small white opake creeping fibres which anastomose freely, and have a central canal continuous with the stomachal cavity of the polypes. (Plate I. fig. 6, a.) This structure establishes and maintains a direct communication between all the individuals of the same cluster (lib. cit. p. 234), and renders the alimentary matter digested by a single polype available to the nutrition of the entire colony. We are not exercising an over-caution in the expression of a wish that this singular part of their anatomy were confirmed. Mr. Hassall has taken no notice of it; and its existence is denied by Van Beneden. (Bull. de l'Acad. Roy. de Brux. xii. no. 2, p. 13.) Is it not possible that, in the specimen examined by M. de Quatrefages, the crust of the Hydractinia had overgrown a basis previously occupied by some Sertularia, and that the network he describes is the remainder of the root-fibres by which that Sertularia had been affixed?

Besides its propagation by buds and bulbules, as he happily names the reproductive bodies that bourgeon from the

tentacula, M. de Quatrefages tells us that he has found true ova in the substance of the common horny base, situated principally near the insertion of the polypes thereon, and at the roots of the elevated spines which roughen its surface. He conjectures that these eggs escape from their seminal bed through the spines, which are supposed to be hollow and open at the top. (Ann. des Sc. Nat. xx. p. 242-3.) The correctness of these observations may be doubted.

1. H. ECHINATA, *basal crust muricated: polypes white, the body elongate, clavate above and furnished with numerous rather short tentacula.* George Montagu.

PLATE I. FIG. 4—6.

Alcyonium echinatum, *Flem.* Brit. Anim. 517. *Johnston* in Trans. Newc. Soc. ii. 251, pl. 9, fig. 2. *Blainv.* Actinolog. 525. *Gray* in Zoologist, i. 204. *Gould's* Massachus. 351.—Alcyonidium echinatum, *Johns.* Brit. Zooph. 304, pl. 42, fig. 3, 4. *Couch* Corn. Faun. 134.—Coryne squamata, var. *Johns.* Brit. Zooph. 111, pl. 2, fig. 4, 5. *Couch* Corn. Faun. 12, pl. 1, fig. 2.—Echinochorium clavigerum, *Hassall* in Ann. and Mag. N. Hist. vii. 371, pl. 10, fig. 5. *Macgillivray* in Ibid. ix. 463. *Hassall* in Ibid. xii. 117.—Coryne Hassalli, *Forbes* in Ann. N. Hist. xii. 189.—Hydractinia lactea, *Van Beneden* Les Tubul. 64, pl. 6, fig. 7-14. Ann. N. Hist. xv. 250.—Synhydra parasites, *Quatrefages* in Ann. des Sc. Nat. xx. 232, pl. 8 and 9.

Hab.—On old univalve shells from deep water; not uncommon, and generally distributed.

Mr. John Macgillivray tells us that, in the neighbourhood of Aberdeen, this zoophyte is "of frequent occurrence on Buccinum undatum, Fusus antiquus, and F. corneus, brought up by the fishing-lines." It is found similarly situated on all parts of the British coast, growing in clusters of a milk-white colour on the shell. The polype is about the quarter of an inch in height, and its filiform stalk or pedicle gradually passes into a clavate head, which is surrounded, under the apex, with an irregular series of short tentacula. These vary in number: the figures of Professor Forbes represent individuals with from three to ten; those figured by us, in the first edition of this work, had from twelve to fifteen; and, according to Mr. Hassall, they frequently amount to between twenty and thirty, and are somewhat club-shaped;—a shape that depends on their degree of contraction. The ova are simple, or have only a single vitellus, and the opake part is yellowish: "les œufs en grappe avec le sinus jaune." *Van Beneden.*

The crust secreted by the polypes, and which associates them

together, "is about the one-twentieth of an inch in thickness. When first taken out of the water, it is soft and spongy, but becomes rigid on drying;" and, in this state, the surface is muricated with papillæ, about a line in height, and rough with minute prickles pointing upwards.

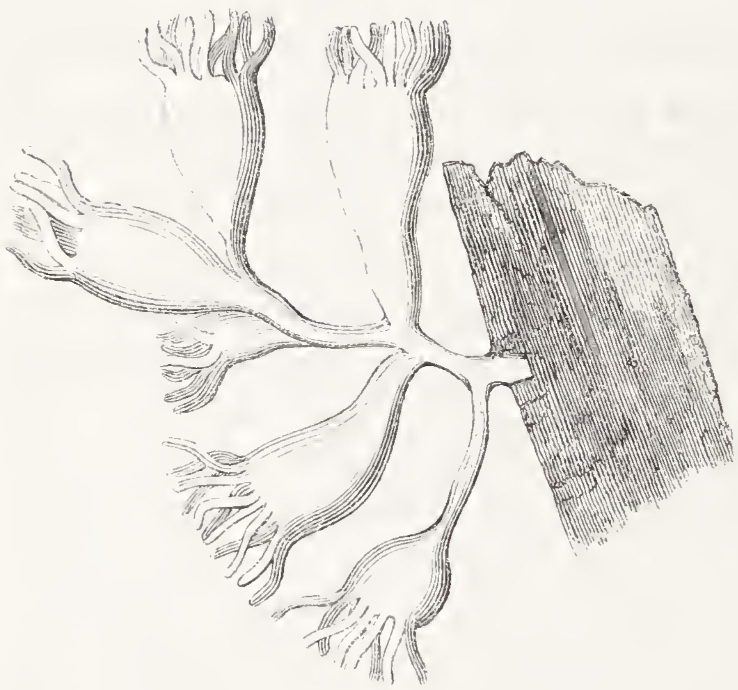
It was long believed that the connection between this muricated crust and the soft polypes was only accidental. In this country Mr. Hassall was the first to affirm the contrary. His observations appeared to me insufficient to prove their constant and organical connection, and Professor Edw. Forbes contended strongly for the older view. It is now unnecessary to enter into the discussion, for the correctness of Mr. Hassall's conclusion is proved by the prior observations of Van Beneden, and by the more recent researches of Philippi and M. de Quatrefages; for I have no doubt whatever of the sameness of the species these various naturalists have described. It is very true, that, in Van Beneden's excellent figure, the crust is represented as being even and smooth; but there are scattered remarks in his reply to M. de Quatrefages, which imply that it was actually rough; and we know, that when fresh and living, the crust, which appears so rough when dried, is covered with an organic slightly diaphanous jelly, which almost conceals the murications, and beyond which they scarcely project.

The shells which Hydractinia echinata infests, are usually tenanted by the Hermit-Crab; and I have often noticed the rim of the aperture of the shell to be extended by the growth of the zoophyte in the form of a horny membrane, by which the capacity of the crab's domicile was much enlarged. Mr. Gray has made similar observations. He says, "This Alcyonium gradually enlarges, and, being moulded on the body of the Hermit-Crab, forms for that animal a house adapted to its growth, so that it has no necessity either to enlarge its house by the absorption of part of the cavity of the shell which it inhabits, or by leaving the shell, and seeking for another better adapted to its size, as other specimens are obliged to do, which have not the assistance of the coral. One can understand that the crab may have the instinct to search for shells on which the coral has begun to grow; but this will scarcely explain why we never find the coral except on shells in which Hermit-Crabs have taken up their residence."

I am almost persuaded that *H. echinata* is the same species as the *Hydra capitata* of Müller, Zool. Dan. prod. no. 2790; and that his *H. brevicornis* is the same animal in its young state, when only eight tentacula have been developed.

Mr. Templeton has figured a zoophyte under the name of Hydra corynaria (Mag. Nat. Hist. ix. 419, fig. 58), which is more akin to Hydractinia than to any other known genus. It was "found adhering to Fucus vesiculosus, at White House Point, Belfast Lough, October 1810." The figure represents it as a branched animal with enlarged clavate heads, encircled, round the truncated apex, with tentacula rather shorter than the diameter. Dr. Fleming has described the same animal by the name of *Hydra lutea* (Brit. An. 554); and Professor Jameson gives a *Hydra lutea* as a native of the Frith of Forth. (Wern. Mem. i. 565.) Being satisfied that the species was distinct from both the Hydra lutea and the H. corynaria of Bosc, I named it H. littoralis. (Brit. Zooph. 98.) It may be the same, however, with *Hydra minuticornis* of Müller (Zool. Dan. prod. no. 2788), but a more satisfactory description is required.

Fig. 4.



3. Coryne*, Gærtner.

Character.—*Polype sheathed in a thin horny membrane or tube, branched and subphytoidal, the apices of the branches polypous, clubbed, and furnished with short tentacula with globular tips and arranged without order; mouth terminal: ovules separate, very shortly pedicled.*

When Sars and Ehrenberg determined on the subdivision of the genus *Coryne* of Lamarck, they assumed as the type of their new genus the Coryne pusilla of Gærtner, and took, as the representative of their genus Coryne, the Hydra squa-

* Coryne=clava=a club.

mata of Müller. In the first edition of this work I followed the same course, influenced by a remark of Milne-Edwards, that the latter species was the type of the older genus; but I have since learned that to continue this nomenclature would be to perpetuate a grievous error. Gærtner was the author of the genus Coryne, but since he did not know the Hydra squamata of Müller, he could not have that polype in view when he established his genus. His description has reference solely to the animal before us, to which he assigned the name Coryne, and from which it ought not to have been severed; and, notwithstanding the confusion in terms that may be the result, I feel it to be a bare act of justice to the memory of Gærtner to return to his own nomenclature. The genus then as now adopted by us is exactly synonymous with the *Stipula* of Sars, the *Syncoryna* of Ehrenberg, and the *Hermia* of the first edition of this book.

Gærtner placed Coryne in the family Tubulariæ, but from these its real kindred, it was divorced by Cuvier and Lamarck, who knew the species only at second-hand. According to Van Beneden, it was Blainville who first of all recent naturalists restored it to its place; and, perhaps, it was;—yet the Rev. Dr. Fleming had previously used words which led to that restoration. "We are inclined to consider," says this eminent naturalist, "the Coryne as one of the Tubulariadæ, having a reduced sheath, and agreeing in the tentacular origin of the ovaria." A more correct view cannot be taken: the Coryne is a reduced Tubularia,—a composite and branched polype with its associating medulla contained in a horny tube wrinkled at intervals, as the Tubularia is.

The stomach and body of the polype is confined to the dilated portion or head of the branches: it is more opake and solid than the medulla in the stalk, and distinctly separated from it behind. Apparently the horny sheath or skin encloses it entirely, but at intervals the paler apex opens wide for the admission of the food.

The tentacula are comparatively very short. They consist of a stout stalk and a globular head; which form, says Van Beneden, is merely the result of contraction, for there is no globosity there in the active and vigorous polypes. The stalk is solid and colourless, with a dusky streak in the

centre, tapered gently upwards, and coated with a very thin faintly wrinkled skin ; while the head is white or faintly coloured, and muricated or roughened with sharp points. Mr. Lister says that it is covered with "short projections like blunt hairs;" "and it seems," he adds, "to be by their means that the polypi attach with a touch, or release at will, substances that drift within their reach." According to Mr. Hassall, the murications, on the contrary, seem to be "minute cups, similar to those of the cuttle-fish." M. Loven has taken the same view of them. This discrepancy I ascribe to the different manner in which I presume the observations on the organs in question to have been made. Lister's description accords well with my own observation when I have viewed the head at freedom; and the appearance of cups has only been produced when this was compressed between plates of glass. To me the granules or "blunt hairs" appear to be of a glandular nature, secreting a tenacious mucus. When brought in contact with a foreign body, the tentacula instantly adhere to it with sensible firmness; and the act is too instantaneous to be the result of the application of suckers, or of any power dependent on muscular action. But the secreted glue is ever ready to act, and I have more than once seen a film or line of mucus stretched between the foreign object and the head of the tentaculum, when this was naturally withdrawn by the animal itself.

On a first glance we are apt to imagine that the tentacula could be of little service to the polype; for, even when they have fixed the errant prey, their shortness must prevent them reaching it to the mouth. This is true, but the difficulty is remedied by the mobility of the head, which can not only be shortened and lengthened at will, but can be turned in any direction, and bent at the same time into a perfect circle, so that its extremity may be applied to whatever tentaculum the prey is adherent to.*

About the roots of the tentacula there are generally present some of the reproductive capsules. These are of a round shape and rose colour, consisting of a soft mucous coat or skin enclosing a dark central nucleus. I have found each of

* "Orificium dilatat, capitulum vibrat, et papillas prolongat abbreviatque; qui motus unicus."—*O. Fabricius.*

them to contain several ovules, which, by their aggregation, formed the nucleus. They were globular, smooth, of a faint rose colour, and invested with a pellucid membrane. Many had an indentation in one side, and others were kidney-shaped or ovate; and, while most of them seemed to be homogeneous, in others the germinal vesicle was easily perceived, sometimes near the centre, and sometimes placed near the edge. They did not move; but, as the capsules dissolved away, they fell down or hung about the parent heads, without suffering further change. This was owing, no doubt, to the decay induced by commencing putridity in the water; for, under favourable circumstances, they would have become embryos somewhat resembling Medusæ, and furnished with four long flexible tentacles.

1. C. PUSILLA.—Gærtner.*

PLATE II.

Coryne pusilla, *Gærtner* in Pall. Spec. Zool. fasc. x. 40, tab. 4, fig. 8, copied in Encyclop. Method. pl. 69, fig. 15, 16.—Tubularia Coryne, *Pallas* in lib. cit. *Turt.* Gmel. iv. 668. *Turt.* Brit. Faun. 210.—Hydra ramosa, *Fabric.* Faun. Groenl. 348.—Coryne glandulosa, *Lam.* Anim. s. Vert. ii. 62: 2de édit. ii. 74. *Fleming* in Edin. Phil. Journ. ii. 87; and viii. 295. *Flem.* Phil. Zool. ii. 616, tab. v. fig. 2. *Flem.* Brit. Anim. 553. *Johnston* in Trans. Newc. Soc. ii. 253; and in Mag. Nat. Hist. v. 631, fig. 110. *Blainv.* Actinol. 471. pl. 85, fig. 3, 3 *a*, copied from Gærtner.—Syncoryna pusilla, *Ehrenb.* Coral. des roth. Meer. 70. *Van Beneden* Les Tubul. 53, pl. 3, fig. 1-10.—Hermia glandulosa, *Johns.* Brit. Zooph. 111, vign. no. 12, and pl. 4, fig. 1, 2. *Thompson* in Ann. Nat. Hist. v. 249. *Hassall* in Ann. and Mag. N. Hist. vii. 283, pl. 6, fig. 2. *Couch* Zooph. Corn. 3: and Corn. Faun. iii. 12, pl. 1, fig. 3.

Hab.—On sea-weeds and stones between tide-marks; on old shells, and often parasitical on Tubularia indivisa.

Polypes gregarious, adherent by a tubular fibre which creeps along the surface of the object on which they grow, seldom more than an inch in height, irregularly branched; the stem filiform,

* Gærtner, Joseph, M.D., a native of Wurtemburg, born in 1732; elected F.R.S. in 1761; died in 1791. Having visited England, he made several zoological discoveries on the southern coast, published in the Phil. Trans., and the Spicilegia Zoologica of Pallas. He is celebrated for his work "De Fructibus et Seminibus Plantarum." There is an interesting biographical sketch of him in Thomson's *History of the Royal Society*, p. 46-7.

tubular, horny, subpellucid, wrinkled and more or less distinctly ringed, especially at the origin of the branches, which are of the same size and structure as the primary stalk. Each branch is terminated with an oval or club-shaped head of a reddish colour, armed with short scattered tentacula tipt with a globular apex. The ends of the branches are, apparently, not perforated, but completely covered with a continuation of the horny sheath of the stem. The animal can bend its armed heads at will, or give to any separate tentaculum a distinct motion and direction; but all its movements are, in general, very slow and leisurable.

When parasitical on Tubularia this zoophyte surrounds the stalks, for the space of an inch or more, with a thick beard-like mossiness composed of entangled corneous fibres, not coarser than a sewing-thread, and more irregularly branched than when the polypes have greater freedom to spread. This variety is figured on Plate IV. Fig. 1, 2.

The zoophyte is much infested with parasites, and I have seen specimens so completely overrun with Vorticellæ and young Confervæ, that they appeared, under the microscope, nearly as mossy and glandulous as the stalks of the moss-rose.

As the original description of Gærtner is contained in a book now seldom to be met with, I am induced to give it here entire:—Coryne pusilla. "Stirps subramosa, filiformis, papyracea, geniculata, basi angustior, absque radiculis adnata fucis, præsertim *fœniculaceo ;* coloris nunc arenacei nunc saturate rubri. Caulem et ramos terminant capsulæ ovato-acuminatæ, apice foramine vel ore varie dilatabili perforatæ, eodem cortice (paulo tantum molliore) quo reliqua stirps vestitæ, atque per omnem superficiem armatæ *tentaculis* cylindricis, apice globosis, aqueo-diaphanis, non retractilibus. Caulis et rami mucosa gelatina, capsulæ autem paulo duriore *carne* intus repleta sunt; hæ tamen ita, ut rugosa supersit cavitas recipiendis cibis destinata. Ad basin capsularum majorum adultiorumque exigua sæpe verruca vel tuberculum conspicitur, an prolifera gemmula?" Addit Gærtnerus: "a Tubularia ut non longe distet *Coryne*, ab ea tamen differre, ipsissima tua verba, *Elench. Zooph.* p. 79, 80, suadent. Caput Corynes pro lubitu animalis retractile non est, nec pinnulis, sed veris tentaculis, utut pariter non retractilibus instructum; tentacula enim illa quidquid est idoneæ prædæ arripere, junctisque, si opus, viribus illud ori admovere ipse plus semel vidi, ut de usu eorum dubium nullum sit. Cortex præterea capitis pro transmittendis tentaculis perforatus, itidem non lente inter utrumque horum Zoophytorum discrimen præbet."

The proof which Gærtner gives in this passage of the use of the tentacula has reference to the opinion expressed by Pallas, that they were probably respiratory or branchial organs: "Apparatus hicce pinnularum circa caput, non tam tentaculorum officium præstare videtur quam *branchiarum;* saltem immobilis earum in vivo animali inutilitas, et analogia branchiarum in plurimis Serpularum speciebus haud dubie ad caput positarum, hoc suadent."—*Elench.* p. 80. Van Beneden has recently embraced this opinion. The tentaculum of the Tubularinæ, he says, is not an organ of prehension, and he likes better to consider it as an organ of respiration. —Recher. sur les Tubulaires, p. 17.

Five species of the genus Coryne have been described, but the characters by which it is proposed to distinguish them seem to be of very insufficient validity,—producible by age and by peculiarities in their respective sites. As most of the species have already been indicated as British, I shall give in this place some account of them all; and the student will thus be enabled to form his own opinion when he comes to name his specimens.

1. *C. pusilla,* "sesquipollicaris, arenacea vel saturate rubra, ramosissima, ramulis paucis, validioribus, tortuosis, apice polypiferis, prole ignota."—*Ehrenberg.* Van Beneden says that the polypidom is transparent, pale yellow, thin, irregular, and flexile, very flexuous, and only a little ringed. Its transparency permits the circulatory movement within the stem to be seen. There are about twelve tentacula, placed in fours in three rows, at an equal distance from each other; but individuals occur with the tentacula in two rows only, and it is sometimes very difficult to recognize any regularity in their disposition. The ovules are simple, and situated at the base of the lower tentacula; they are proportionally very large, and there are not more than two or three on any one polype. The embryo at birth resembles a miniature Octopus with four tentacles or arms. (This appears to be what we have figured on Plate IV. Fig. 1, 2. If a species, it is evidently not the C. pusilla of Gærtner.)

2. *C. Listerii,* "tige cornée, annelée assez régulièrement dans presque toute sa longueur, ramifiée; tentacules ou nombre de seize environ."—Coryne, *Lister* in Phil. Trans. an. 1834, p. 376, pl. 10, fig. 3.—Syncoryna Listerii, *Van Beneden* Les Tubul. 54, pl. 3, fig. 11, 12. This is readily distinguished, says Van Beneden, from the preceding by the polype, which is larger, longer, and furnished with a greater number of tentacula, which are arranged also with less regularity. Yet in some individuals a spiral arrangement is indis-

tinctly perceivable. The polype is of an amaranth-red colour. The polypidom is horny and thickish (très-consistant), while it is papyraceous in the C. pusilla; and it is also regularly annulated in some places, almost as in the Campanulariæ. (This is the species represented in our Plate II., and is probably the true C. pusilla.)

3. *C. ramosa*, "bipollicaris, hyalina, ramosa, ramulis basi contractis, capitulis valde elongatis, prole in capitulo sparsa."—*Ehrenberg* Corall. 71.

I have not seen either the description or figure of Sars, the only author who has described this species; but I have specimens of a Coryne from Mrs. Griffiths which appear to be referable to it. They are found on the coast of Devonshire. The polypidom is erect and plant-like, rooted by a creeping tortuous fibre, rising to the height of an inch and a half or even two inches, branched, the branches alternate, erecto-patent, spreading on all sides, and each terminated with the polypous head. The stem and branches are of the same calibre: they are as thick as ordinary thread, filiform, horny, and ringed throughout with close-set regular annuli. The branches are usually a little constricted at their origins. The polype is oblong, freer than ordinarily from the tube, and separated by a narrow neck, with from ten to twelve, or more short tentacula scattered over the surface. The ovules are round, shortly pedicled, produced at the roots of the tentacula; and on a few heads they surrounded the base just underneath the inferior range of these organs. Plate VI. Fig. 4, 5.

The size to which this attains, and its more decided annular character, may be ascribed to a favourable locality; and at all events a character which is only a higher development of one common to the genus can scarcely be considered specifical. I received my first specimen of the Coryne before me from Mr. Thompson of Belfast, who finds it parasitical on littoral sea-weeds and corallines in Strangford Lough and on the Dublin coast, and from this imperfect specimen the figures 6, 7, in Plate VI. were taken. The specimen was of an olive-green colour. It answered so well to the character of the *Tubularia muscoides* of Linnæus that it was referred without hesitation to that species; and it now comes to be a question whether this Coryne and the Tubularia muscoides are not identical.

With the assistance of Dr. Baird, who has sent me Agardh's description of this Tubularia, and a tracing of his figures, I can answer the question in the affirmative. Linnæus defines it "Tubularia culmis subdichotomis, totis annuloso-rugosis." The

description of Agardh is, "Radix, s. a. s. *Frondes primariæ* capillares, tubulosæ, sesquiunciales vel parum ultra, capillum porcinum crassitie duplo superantes, eandemque crassitiem per totam longitudinem servantes, a basi ad apicem totæ annulosa-rugosæ, obtusæ, dichotomæ. *Rami* frondi veluti appositi, basi parumper bulbosi, cæterum frondi primariæ similes, ejusdemque crassitiei. *Substantia* flexilis fere confervoidea; *exsiccatæ* satis tenax, nec, ut in cæteris, fragilis. *Color* corneo-viridescens, subpellucidus: *Siccata* chartæ parum vel laxe adhæret."—The applicability of this description to our Coryne is evident, and hence the latter has the following synonymes:—Tubularia muscoides, *Lin.* Syst. 1302 (exclus. syn.) *Oliv.* Zool. Adriat. 276. *Agardh* in Kongl. Vet. Acad. Handling. 1816, 256, tab. 7, fig. 1, a. b. *Lamour.* Expos. Method. 17, tab. 68, fig. 6, 7. *Thompson* in Ann. Nat. Hist. v. 250.—Fistularia muscoides, *Müll.* Zool. Dan. prod. 254.—Fistulana muscoides, *Fabric.* Faun. Groenl. 442.

4. *C. Chamissonis,* "semipollicaris, nigricans, minor (priori valde affinis), prole collum cingente."—Coryna ramosa, *Chamisso* and *Eysenhardt* in Nov. Act. Phys. Med. Acad. Cur. x. pt. ii. 370, tab. 33, fig. 3.—Syncoryna Chamissonis, *Ehrenb.* Corall. roth. Meer. 71. *Van Beneden* Mém. sur les Tubul. 55. Ann. Nat. Hist. xv. 249.—"*Cor. ramosa,* nob.; stirpe ramosa, ramulis apice clavigeris, clava cylindrica, filamentis apice nodiferis obsita, basi gemmifera."—"In freto La Manche, fuco adhærens.—A *Coryne pusilla,* Cuv. (Pallas, Spic. Zool. x. 4—8) unica præter nostram specie ramosa, differt forma clavæ, et gemmis in ejus basi. Cum autem de metamorphosi animalium hujus generis observationes nullas habeamus, species nostra cum C. pusilla eo modo fortasse convenit, ut gemmæ, in clava inclusæ (unde crassior videtur), ad basin clavæ seponantur ideoque C. pusilla in ramosam commutetur." *Chamisso* and *Eysenhardt.*—Van Beneden thinks that the species has the closest affinity to his Syncoryna Listerii;—they are alike, he says, in habit and in size, but the difference in the position of the ovules is great and important. Our observations, on the contrary, lead us to believe that this character is one of no value. Van Beneden gives the "coast of England" as the habitat, but this is a mistranslation of the Latin—"fretum Anglicum"—of Ehrenberg.

5. *C. Sarsii,* "semipollicaris, capillacea, tubulis $\frac{1}{10}'''$—$\frac{1}{12}'''$ crassis, lævibus; gemmis elongatis, arrectis; parce ramosa. Masc. tentac. 10—16; Fem. globosis, cirris elongatis; oculis exquisite rubris; campanula membrana perforata, clausa.—*Hab.* In fissuris rupium,

etiam in aquâ stagnante, ad insulam Masskoïr, &c., Bahasiæ."—I have copied this character from the Miscrosc. Journ. i. 107. The species is described and figured by M. Loven in the Ann. des Sc. Natur. for March, 1841.

4. Cordylophora,* Allman.

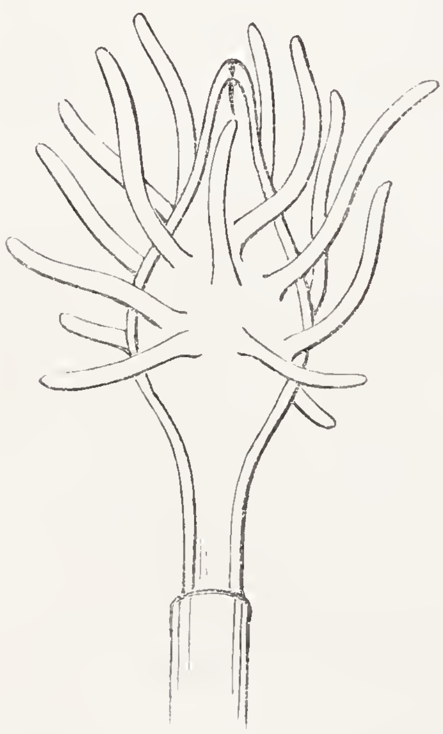
Character.—" *Polypidom horny, branched, rooted by a creeping tubular fibre; branches tubular. Polypes developed at the extremities of the branches, ovoid, bearing the mouth at the distal extremity, and furnished with scattered filiform tentacula.*" Allman.

1. C. lacustris. G. J. Allman.

Cordylophora lacustris, *Allman* in Ann. Nat. Hist. xiii. 330.

Hab.—"The locality of the zoophyte is the dock of the Grand Canal, Dublin. Into this ships have access from the sea by means of a lock, but the dock is quite free from any admixture of sea-water; in fact, did any doubt exist as to the genuine fresh-water habitat of the zoophyte, the circumstance of my having kept it alive for nearly a fortnight in a glass of fresh water not taken from the dock, would be sufficient to dispel them. It grew upon the bottom of an old submersed canal boat, but as yet I have obtained it in but very small quantity."—*Allman.*

Fig. 5.



" Polypidom horny, rooted by a creeping tubular fibre, alternately branched, branches cylindrical. Polypes developed at the extremities of the branches (Fig. 5), and consisting of an ovoid body, prolonged anteriorly into a conical projection, which bears the mouth at its extremity, and behind which the body of the polype is furnished with scattered filiform tentacula."—*G. J. Allman.*

* From Κοϱδυλος, a water-newt, and φοϱα, a burden.

FAMILY—TUBULARIADÆ.

Genus TUBULARIA, *Lin.* Syst. edit. x. i. 803. *Pallas* Elench. 79. *Lin.* Syst. 1301. *Lam.* Anim. s. Vert. ii. 108. *Blainv.* Actinolog. 469. *Schweigger* Handb. 424.—Genus FISTULARIA, *Muller* Zool. Dan. prod. xxxii.—Family TUBULARIADÆ, *Johnston* in Trans. Berw. Cl. 107. *Gray* in Syn. Brit. Mus. 76.

CHARACTER.—*Polypidom plant-like, horny, rooted by fibres, rarely free, simple or branched, tubular, filled with a semi-fluid organic pulp: Polypes naked, protruded from the ends of the tubes and not retractile, fleshy and red, armed with one or two circles of smooth filiform tentacula. Bulbules pullulating from the bases of the tentacula, soft and naked. Embryo medusiform.*

5. EUDENDRIUM,* Ehrenberg.

CHARACTER.—*Polypidom rooted by creeping fibres, erect and variously branched, the fibres cylindrical, tubular, filled with a soft pulp: Polypes hanging from the extremity of every branchlet, non-retractile, roundish, somewhat pedicled, naked and fleshy, the body encircled with a zone of filiform tentacula; the mouth central and subtubular.*

1. E. RAMEUM, *arborescent, irregularly branched, the stem and branches formed of agglutinated filiform tubes; ultimate branchlets alternate and single, polypiferous.* G. J.

PLATE V. FIG. 1, 2.

Tubularia ramea, *Pall.* Elench. 83. *Johns.* Brit. Zooph. 117, pl. 5, fig. 1, 2. *Hassall* in Ann. and Mag. Nat. Hist. vi. 167. *Macgillivray* in Ibid. ix. 463. *Couch* Zooph. Corn. 4: Corn. Faun. iii. 15.—Thoa Savignyi, *Lamour.* Expos. Method. 15, tab. 67, fig. 5, 6 (bad).—Tubularia ramosa, *Johnston* in Trans. Newc. Soc. ii. 253, pl. 10.

Hab.—On old shells and on stones from deep water. Shetland and Leith shore, *Dr. Coldstream.* Bay of Whitburn, Durham, *Miss Dale.* Frequent on the coasts of Northumberland and Berwickshire, *G. J.* Scarborough, *W. Bean.* Found attached to an oyster dredged at Whitehaven, Cumberland, *W. Thompson.* Blackrock, Dublin Bay, *Hassall.* Cornwall, on the Pinna ingens, *Couch.* Donmouth, Aberdeenshire, *Macgillivray.* Shores near Liverpool, *Thos. G. R. Rylands.*

* From εὐ well, and δενδρον a tree.

This animal production so perfectly resembles a tree in miniature, deprived of its leaves, that persons unacquainted with the nature of zoophytes, cannot be persuaded that it is not of a vegetable nature. It is from three to six inches high, rooted by a densely interwoven mass of tubular fibres, forming by their cohesion and intertwining the stem, which is sometimes as thick as the little finger. This is irregularly divided into many compound branches formed like the stalk itself, but the ultimate branches consist of a single fibre not thicker than ordinary thread. They are fistular, horn-coloured, smooth, alternate, erecto-patent, appearing as if they were rather soldered to the main tube, than productions of it, wrinkled with a few rings at or near their origins, and sometimes there are a few rings near the middle of the branchlet. The polypes are of a reddish colour, and appear indolent in disposition, contracting slowly under external irritations: they have about twenty whitish tentacula arranged in one row round a broad oral disk.

It is possible this may be a state of E. ramosum, but its arborescent character, and the complexness of its structure, are so remarkable that I have willingly followed the example of Pallas, who has given a description of the species in his usual accurate and expressive style.

2. E. RAMOSUM, *slender, pinnatedly branched, a single tube; branchlets erecto-patent, ringed at their origins, polypiferous.* Ellis.

PLATE VI. FIG. 1, 2, 3.

Corallina tubularia gracilis et ramosa, axillis ramulorum contortis, *Ellis* Corall. 31, no. 3, tab. xvi. fig. *a* ; and tab. xvii. fig. *a*, *A*.—Tubularia ramosa, *Lin.* Syst. x. 804. *Lin.* Syst. 1302. *Soland.* Zooph. 32. *Oliv.* Zool. Adriat. 276. *Berk.* Syn. i. 214. *Turt.* Brit. Faun. 210. *Stew.* Elem. ii. 437. Wern. Mem. i. 563. *Lam.* Anim. s. Vert. ii. 110: 2de édit. ii. 126. *Lamour.* Corall. Trans. 101. *Flem.* Brit. Anim. 552. *Blainv.* Actinol. 470, pl. 30, fig. 3, copied from Ellis. *Hogg's* Stock. 34. *Stark* Elem. ii. 441, pl. 8, fig. 15, from Ellis. *Templeton* in Mag. Nat. Hist. ix. 466. *Thompson* in Ann. Nat. Hist. v. 250. *Lamour.* Expos. Method. 17. *Couch* Zooph. Corn. 4: Corn. Faun. iii. 14. *Gould's* Massachus. 350.—Tubularia trichoides, *Pall.* Elench. 84. *Lamour.* Corall. 101. *Blainv.* Actinolog. 470.—Fistularia ramosa, *Mull.* Zool. Dan. prod. 254.—Eudendrium ramosum, *Ehrenb.* Corall. roth. Meer. 72.

Hab.—On oysters and other marine productions. At Whitstable on the Kentish shore; and at Emsworth, on the borders of Sussex, *Ellis.* Leith shore, found by the late Mr. Mackay, *Jameson.* Very common on stones, mussel and oyster shells near Stockton-on-

Tees, *J. Hogg, Esq.* Found on the shore of Dublin Bay, *Templeton.* Found sparingly around the coast of Ireland, generally investing shells, *W. Thompson.* Scarborough, *Mr. Bean.* Cornwall coast, *Couch.* Devonshire, *Mrs. Griffiths.*

Polypidom rooted by tortuous wrinkled fibres, confervoid, rising to the height of six inches, of a brownish horn colour, and rather solid texture, flexible, smooth, the shoots filiform, of the thickness of common sewing-thread, formed of a single tube, pinnatedly branched, the branches alternate, short, erecto-patent, ringed at their origins, with a plain terminal aperture. The stem is not ringed, in general, either above or below the insertion of the branches, but sometimes there is a ringed space there, and sometimes in the interspaces. The polypes are well figured by Ellis, who says, "I have often met with specimens of this coralline that have been regularly branched in a doubly pinnated form; and when I was at Emsworth, on the borders of Sussex, I found a specimen of this Tubularia, with its ovaries placed in a circle round the lower part of its heads."

I have had small and imperfect specimens of Thoa halecina sent me as E. ramosum; nor is it impossible to mistake the variety of Coryne pusilla which infests Tubularia indivisa for it.

Lamouroux and Blainville make of Ellis' figure in Plate XVI. their *Tub. trichoides,* and they restrict the name *ramosa* to that figured in Plate XVII.; but Ellis himself knew no difference. They certainly appear, on a first glance, very distinct. The latter, which is of a thinner texture and yellowish colour, does not rise to the same height, and is irregularly branched, the branches arising principally from near the base; but there is no difference in their structure, and I distrust a character drawn from habit only in these polypidoms.

I cannot reconcile the description given by O. Fabricius of his *Fistulana ramosa,* either with this or the preceding species. The Eudendrium ramosum, so beautifully illustrated by Van Beneden, seems also distinct; for in Van Beneden's species the apex of the branchlets is enlarged into a sort of funnel-shaped cell, within which the polype is partially retractile.

6. Tubularia,* Linnæus.

Character.—*Polypidom horny, fixed by a creeping fibre, erect, fistular and unbranched, the tube filled with a semifluid medulla: Polypes placed at the extremities of the tubes, non-retractile, fleshy, furnished with two circles of filiform smooth tentacula; "one row surrounds the middle of the heads, and the other is placed round the mouth:" bulbules clustered, shortly pedicled, placed within and at the base of the lower tentacula: embryo sometimes in the form of a Beroe, sometimes of a Hydra.*

1. T. indivisa, *tubes clustered, arundinaceous, narrowed and interwoven at the base, smooth throughout.* E. Lhwyd.†

Plate III. Fig. 1, 2.

Remarkable Sea-plant, *Lhwyd* in Phil. Trans. abridg. vi. 73, pl. 3, fig. 1.—Adianti aurei minimi facie planta marina, *Raii* Syn. 31, no. 4. *Jussieu* in Mém. Acad. Roy. des Sc. 1742, p. 296, tab. 10, fig. 2.—Tubular Coralline like oaten pipes, *Ellis* in Phil. Trans. xlviii. tab. 17, fig. *D.* Phil. Trans. abridg. x. 453, pl. 10, fig. *D.* *Ellis* Corall. 31, no. 2, tab. 16, fig. C., copied in *Esper* Tubul. tab. 27, fig. 1.—Tubularia indivisa, *Lin.* Syst. x. 803. *Lin.* Syst. 1301. *Ellis* and *Soland.* Zooph. 31. *Berk.* Syn. i. 214. *Blumenb.* Man. 272. *Turt.* Brit. Faun.

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* Formed from *tubulus*, a little hollow pipe.—As restricted by the above definition, the genus appears to be synonymous with the Calamella of Oken. See Schweigger, Hand. p. 424.

† Edward Lhwyd, or Lloyd, was born in 1670, and died in July 1709. He was son of Edw. Lloyd of Kidwell, in Caermarthenshire; became, when 17 years of age, a student of Jesus Coll. Oxford, and, upon the resignation of Dr. Plot, was appointed keeper of the Ashmolean Museum. He was distinguished amongst his contemporaries for knowledge in antiquities and natural history. "He is, indeed," writes Archdeacon Nicolson, afterwards Bishop of Carlisle, and very competent to give an opinion, "if I may judge of him, the greatest man (at antiquities and natural philosophy together) that I have had the happiness to converse with."—*Letters to R. Thoresby, F.R.S.*, vol. i. p. 206. Ray gratefully records his assistance in the *Synopsis* and *Hist. Plantarum;* and Petiver frequently mentions him as his "worthy," "curious," and "generous friend."—Of his life and writings the reader will find an account in Pulteney's *Sketches of Botany in England*, vol. ii. p. 110-116; and some additional particulars in the "*Analecta Scotica*," especially in the *Second Series*, published at Edinburgh in 1838. See also Wood's *Athen. Oxon.* v. ii. p. 1094; and *Richardson's Correspondence*, edited by D. Turner, p. 12. The genus *Luidia* of Edw. Forbes is dedicated to his memory. See the Hist. of Brit. Starfishes, p. 136.

210. Stew. Elem. ii. 437. *Jameson* in Wern. Mem. i. 563. *Lam.* Anim. s. Vert. ii. 110; 2de édit. ii. 125. *Lamour.* Cor. flex. 230: Expos. Method. 17. *Cuv.* Reg. Anim. iii. 299. *Bosc* Vers iii. 89, pl. 28, fig. 5: a reduced copy from Ellis. *Flem.* Brit. Anim. 552. *Johnston* in Trans. Newc. Soc. ii. 252. *Dalyell* in Edin. New Phil. Journ. xvii. 411; and xxi. 93; and in Rep. Brit. Assoc. an. 1834, 600. *Lister* in Phil. Trans. an. 1834, 366, pl. 8, fig. 1. *Harvey* in Mag. Nat. Hist. n. s. ii. 511. *Gould's* Massachus. 350. *Thompson* in Ann. Nat. Hist. v. 250. *Couch* Zooph. Corn. 3: Corn. Faun. iii. 13, pl. 2, fig. 1, 2.—Tubularia calamaris, *Pall.* Elench. 81. *Ehrenb.* Corall. roth. Meer. 71.—Tubularia gigantea, *Lamour.* Soland. 17, tab. 68, fig. 5.—La Tubulaire chalumeau, *Blainv.* Actinolog. 470.

Hab.—On shells and stones from deep water, common. The *Tub. gigantea* was sent to Lamouroux from the coast of Norfolk by Dr. Leach, and is said to be very rare. "In the beautiful bay of Rothsay, the Tub. indivisa seems to flourish upright on a muddy ground like a flower, fixed by the tapering root-like termination of its horny case." *E. Forbes.*

The tubes are simple or sometimes divided once at the base, where they are twisted and flexuous, fistular, even, continuous, or sometimes wrinkled at distant intervals with a few annulations, horn-coloured, from six to twelve inches in height, and about a line in diameter. Ellis's comparison of them to "part of an oat-straw, with the joints cut off," is very apt. They are filled with a soft, almost fluid, reddish-pink pulp in organic connection with the polypes, which project from the open ends of the tubes, and are not retractile within them. The body, or naked portion, of the polype forms a globular knob of a scarlet colour, produced above into a sort of proboscis encircled with a series of numerous short tentacula of the same colour. Around the base of this body there is another circle of much longer tentacula, from thirty to forty in number; and between their insertion and the body, clusters of oviform gemmules are produced at certain seasons. The neck of the polype is greatly constricted; and we find that the recent tube is marked with several longitudinal pale lines, placed at equal distances, and which are evidently caused by some structure of the interior pulp, for when empty the tubes exhibit no such appearance. What is their relation to the currents observed by Mr. Lister?—As the animal becomes weak when kept in a basin of sea-water, the head drops off, like a flower from its stalk; and if it be immersed, even when most vivacious, in fresh water, the pulp is expelled from the tubes until these are almost emptied. If this is effected by a contraction of the tube (and the phenomenon is not otherwise easily explained), does not this imply a degree of irritability in the polypidom inconsistent with the theory of its extravascular character?

I can find no characters either in the description or figure of *Tub. gigantea* which warrant its separation as a distinct species. The character given by Lamouroux is : " T. tubulis rectis, simplicissimis, ad basim attenuatis, gradatim dilatatis, deinde æquali crassitie, lævibus nitidisque."

2. T. Dumortierii, *solitary, the polype-tube slender and simple, narrowed towards the base, unwrinkled.* G. J.

Plate VII. Fig. 1, 2.

Tubularia Dumortierii, *Van Beneden* sur les Tubul. 50, pl. 2.

Hab.—On the shell of the Lithodes maja, from Berwick Bay.

The polypidom of this species grows singly or scattered. It is about two inches in height, and about the thickness of ordinary pack-thread, slightly attenuated towards the base, more or less bent, of a straw-yellow colour when dried, smooth and even, and not ringed, but marked with lines produced by the arrests in its growth at uncertain intervals. It is a simple tube with an even patulous aperture. The polypes are of the usual reddish colour. The bulbules are spherical, and shortly stalked.

This is so like T. indivisa, that one might conjecture it was that species in miniature, but there can be no doubt of their distinctness. Upon it Van Beneden made his most interesting observations, and he has delineated all the phases of its life in a beautiful series of figures.

3. T. Larynx, *tubes clustered, slender, cylindrical, ringed at distant and regular intervals.*

Plate III. Fig. 3; and Plate 5. Fig. 3, 4.

Var. α. The tubes simple or undivided.

Var. β. The tubes subramose. Tub. ramosa, *Esper* Tub. tab. 9, fig. 1-3.

Fucus Dealensis fistulosus, laryngæ similis, *Raii* Syn. i. 39, no. 8. *Petiv.* Oper. iii. 39, no. 406. *Ellis* in Phil. Trans. abridg. x. 453, pl. 10, fig. *c*; and xi. pl. 5, fig. 3, young.—Tubulous Coralline wrinkled like the windpipe, *Ellis* Corall. 30, no. 1, tab. 16, fig. *b*.—Corallina tubularia laryngi similis, *Bast.* Opusc. Subs. 41, tab. 2, fig. 3, 4; and tab. 3, fig. 2-4.—Tubularia muscoides, *Pall.* Elench. 82. *Berk.* Syn. i. 214. *Turt.* Brit. Faun. 210. *Esper* Tub. tab. 4, fig. 1, 2. (The figures in tab. 4 A are all copied from Baster.) *Stew.* Elem. ii. 438. *Lamour.* Corall. 101. *Flem.* Brit. Anim. 552.—Tubularia Larynx, *Ellis* and *Soland.* Zooph. 31. *Lam.* Anim. s. Vert. ii. 110; 2de édit. ii. 126. *Hogg's* Stock. 34. *Thompson* in Ann. Nat. Hist. v. 250. *Hassall* in Ann. and Mag. N. Hist. vii. 284. Macgillivray in Ibid. ix. 463. *Gould's* Massachus. 350.—Eudendrium bryoides,

Ehrenb. Corall. des roth. Meer. 72.—Windpipe Coralline, *Couch* Zooph. Corn. 4 : Corn. Faun. iii. 13, pl. 2, fig. 3.

Hab.—On submerged wood, shells, and corallines, within low-water mark. "In Belfast and Strangford Loughs is chiefly parasitic on Desmarestia aculeata. From about every inch or so of the stem and main branches of the plant, the tubes issue somewhat in a whorled manner to about the distance of one or two inches on every side. In Belfast Bay, Mr. Hyndman dredged a fine specimen, $3\frac{1}{2}$ inches in height, and as much in breadth, though springing from a single base : the tubes are simple throughout." *W. Thompson.*

Polype-tubes clustered, about two inches in height, undivided and filiform, more or less entwined at the base, of a thin pellucid pale corneous texture, wrinkled and annulated at intervals, whence each tube assumes somewhat the appearance of the windpipe of a small bird. In *var.* β. the tubes are distinguished by being slightly branched, the branches coming off irregularly and at various angles. "The polypes are naked, with two circles of tentacula. The head is light red; the tentacula are white, or white fringed with red. The reproductive gemmules rise from the base of the tentacula." *Couch.*

Mr. R. Patterson of Belfast has communicated to me the following novel observation. He had dredged a specimen of T. larynx, and one of the polypidoms was detached. On placing the specimen in a jar of sea-water, "this severed one, by its change of place, caught my eye. It was not merely that it was sinking in the jar, but that it was coiling itself up, uncoiling, stretching, twisting, knotting itself, in a way that resembled the Gordius aquaticus. To this fact, therefore, I want to call your attention,—that the stem is not only flexible, but, under certain circumstances, is truly and entirely under control of the zoophyte."

It has been so confused with others that it is unsafe to give every assigned habitat for this species, which, however, appears to be common and generally distributed on the British coast. It was first of all "found about Deal by the Reverend Mr. Hugh Jones and Mr. James Cuninghame," as Petiver tells us. The former was "a very curious person in all parts of Natural History, particularly in Fossils, some of which he hath sent me from Maryland, with several volumes of Plants very finely preserved; with divers Insects and Shells. From this obliging gentleman I am promised frequent remittances of whatever those parts afford, as well Animals and Fossils as Vegetables." *Petiver.*

Cuninghame was a Surgeon, probably in the East India Com-

pany's service, and had visited those places which lie in the course of its trade, whence he brought numerous plants, &c. to enrich the museum of Petiver. The latter styles him "that industrious promoter of Natural Philosophy, and my very ingenious friend;"—"my very worthy friend;"—"my hearty friend;" and the 20th plate of Petiver's *English Plants* is gratefully dedicated to the *memory* of this "his curious friend," to whom he says he was "beyond expression obliged." Cuninghame is the author of a paper on the plants of the island of Ascension in Phil. Trans. no. 255; and seems to have deserved the praises which his contemporaries bestowed.

4. T. GRACILIS, *clustered, the polype-tubes slightly branched at the base, slender, smooth and unwrinkled; bulbules spherical, shortly pedicled.* J. B. Harvey.

PLATE IV. FIG. 3, 4, 5.

Tubularia gracilis, *Harvey* in Proc. Zool. Soc. 1836, no. 41, p. 54.—Tub. larynx, var. β. *Johns.* Brit. Zooph. 116.—Tub. calamaris, *Van Beneden* sur les Tubul. 46, pl. 1. fig. 1-6.

Hab.—In deep water, parasitical in tufts of Tubularia indivisa and Eudendrium rameum.

This species grows in complicated tufts: the tubes are about three inches in height, slender, of a pale colour, thin and corneous, smooth and unwrinkled, except after being dried, when some parts appear to be slightly wrinkled, particularly at the origin of the branches. The naked body of the polypes is rose-red, more or less deeply tinted, while the tentacula are milk-white or faintly tinged with red. The oral series is very short, and usually held in an erect position: the other forms a circle round the most bulging part of the body, and consists of more than twenty long filaments, which spread like rays from a centre, or droop elegantly, being usually held still, or allowed listlessly to follow the undulations of the water. When the polypes are all displayed, they afford a very interesting spectacle, equalled by no other species I have seen; the crimson heads contrasting finely with their white polypidoms, especially when loaded with the reproductive bulbules which pullulate from the inner side of the bases of the inferior tentacula. When few in number and immature, these bulbules are sessile and separate, but in their progress to evolution they form grape-like clusters: each sepa-

rate bulbule is of a roundish or oval shape, consisting of a white albuminous coat with a dark red centre.

Van Beneden has referred this Tubularia to the T. calamaris of Pallas, from which the size alone is sufficient to prove that it is distinct. I have felt rather uncertain whether to refer our species to Van Beneden's T. calamaris or to the T. coronata of Abildgaard; but in the latter the polype-tubes are simple or unbranched, while most of our specimens are branched near the base, as they are in T. calamaris of Van Beneden. The real distinction between the species is this: in *T. gracilis* the bulbules are shortly pedunculated, while in *T. coronata* they are supported on a long branched pedicle. Perhaps T. gracilis, Harvey, may be found to belong to the latter. Mr. Harvey says that the tube is "hollow throughout and single;" but then he describes the bulbules as if they were sessile,—"two or three confused rows of alternate white and red short papillæ." Mr. Harvey found his specimens in a locality where they can easily be re-examined: "at the steam bridge on the river Dart, where it grows in clusters between the links of the chain over which this floating bridge is propelled." And he adds, "I have since observed the same animals growing on the links over which the floating bridge at Devonport runs, and there they do not occupy a space exceeding 150 feet." I have observed what is undoubtedly the same species in a similar position at Southampton.

Of the Tubularia polyceps (Rep. Brit. Assoc. 1834, p. 601; and Edin. New Phil. Journ. xxi. p. 93.) Sir J. G. Dalyell has given no description. It is probably the same as our T. gracilis.

The Tubularia flabelliformis of *Adams* in Lin. Trans. v. p. 12, is a minute parasitical alga of the family Diatomaceæ.

7. Corymorpha,* Sars.

Character.—*Polypidom subcylindrical, short, very thin and membranous, rooting in sand and bulged at the base: Polype elongate, naked above and free of the polypidom; the head clavate, encircled near the base with a series of long filiform tentacula, and around the proboscidiform mouth there is another set of short ones.*

* From κορυνη a club, and μορφη form.—The generic character of Sars is as follows: "Corpus longum, cylindricum, molle, superne clavato-vesiculosum, inferne conico-attenuatum, tubulo cutaceo hyalino tenuissimo partem corporis inferiorem circumdante, libere (non affixum) insidens. Clava conica, basi serie tentaculorum longorum circumdata, et os tentaculis brevibus sparsis."

1. C. NUTANS.

PLATE VII. FIG. 3—6.

Corymorpha nutans, corpore hyalino, lineis longitudinalibus pallide rubris, *Sars* Beskriv. 7, pl. 1, fig. 3.—*Forbes* and *Goodsir* in Ann. Nat. Hist. v. 310.

Hab.—"We found the *Corymorpha* in 10-fathom water, in a sandy bottom in the Bay of Stromness, Orkney." *Forbes* and *Goodsir.*

"The *Corymorpha nutans* is about four and a half inches in length, and its stem at the thickest part half an inch in diameter. In form it resembles a *Tubularia* rather than a *Coryne;* but not being placed in a strong horny tube, like the former, presents much of the habit of the latter. When young, the greater part of the body is enclosed in a thin brown membranous tube, which appears to have no organic connection with the animal, and which, growing thinner as the animal gets older, at last disappears altogether. The body or stem is rounded, solid, and flexible, and is somewhat thicker towards the base than above, where it tapers rather suddenly to the neck. The base is fusiform and tapering to a point, and roots in the sand, fixing itself there by means of branching filamentous roots. When sand is much gathered round these roots, they present that subglobose appearance seen in M. Sars's figure. The whole of the stem is translucent, of a white colour tinged with pink, and lineated with pinkish-brown, longitudinal lines arranged in pairs. When magnified, these lines are seen to be composed of oblong dots. M. Sars described these stripes as being of a pale vermilion colour in his specimens. These lines do not run down the fusiform root, neither do they extend upwards quite to the neck, round which there is a band of pink. Above the neck is the head, which is ovate or pyriform, and terminates in a long pyramidal pink trunk, at the extremity of which is the mouth. Round the thickest part of the head is placed a row of between forty and fifty tentacula, which are very long, white, and not contractile. They are not ciliated. Immediately above this circle of tentacula are the ovaries, which are fourteen branched orange-coloured processes of considerable size, about one-third as long as the tentacula, each of their branches terminating in a sort of head. Above these the trunk is covered with very numerous white tentacula, directed upwards, not contractile, and very much shorter than those of the lower circle.

"The internal structure is as follows: The stem is entirely solid, the substance filling it being jelly-like in appearance, as if contained in cells of a slightly fibrous tissue. When a transverse section of the stem is made in the living animal, the outer mem-

brane contracts so as to diminish the dimensions of the amputated portion. No vascular structure could be detected, on the most minute examination of transverse and longitudinal sections of the stem; nor could any current be observed, either with the naked eye or the microscope, in this part of the living animal. The tentacula are all solid, and composed of the same substance as the stem and head. Within the head is the stomach, opening externally by a small circular mouth without any fringe or oral apparatus. This stomach is flask-shaped, having an elevated floor like the bottom of a bottle. It does not descend below the level of the lowermost range of tentacula. Its internal surface is villous, but not ciliated; neither are there any cilia on any part of the body.

"This description of the internal structure differs from that of M. Sars, who says, 'If the skin of the polype, which is pretty strong, be cut up, the interior is found quite empty, without any intestines, except a small cylindrical gut or stomach, which at the upper end is a little wider than at the lower, and runs straight from the mouth downwards without bending to the lower half of the body, or a little lower, where it terminates abruptly; a large number of threads joined by net-work diverging like rays from its end towards the skin, where they fasten themselves. On this stomach are also to be seen strong longitudinal stripes.' This appearance is presented only by the animal after having been kept for some time in alcohol; but we can assert positively that no such structure exists in the living animal. Misled by the above fallacious appearance, M. Sars has drawn a false analogy between it and the *Actineæ*.

"To what we have said of the deciduous tube, one of the most extraordinary points in the œconomy of this zoophyte, we must add that the filaments branching from the roots are, properly speaking, processes of its tube; for the young animal may be drawn out of its tube uninjured, and then the tube and the roots will be seen entire. In the adult animal the filaments and that part of its tube which envelopes the root still remain, while the upper part disappears. As ovaries of the specimen described by M. Sars were much further advanced than those in our examples, we quote the following observations from his account of them: 'They are for the most part two-branched; at the end of the branches, the eggs, improperly so called, were seen resting, heaped together in large quantities. These eggs or buds have an exceedingly remarkable form and internal construction. For if they are examined with the microscope, it

will be found that they have an oblong-round conformation, broadest at the top, and slightly blunted; smallest at the bottom, and fastened by a very short stem to the branch. If considered still more attentively, it will be seen that these eggs (the internal structure is easily observed in consequence of their transparency) seem already to contain within them the most important parts of the future polype. For instance, we observe in the middle a part which in form, &c., corresponds to the knob in the full-grown animal. This part in the various eggs is of various forms: in the smaller ones, round or oblong; in the large and best developed, perfectly bottle-shaped. Further, there are observed in the upper or broad end of the egg four roundish projecting knots, which internally are continued as tubes downwards to the base of the bottle-shaped part. One of these knots is always larger and longer than the other three, which are alike, and it terminates after a small indentation with another small projecting knot. It therefore occurs to me as not improbable, that the largest knot, with its interior continuation, develops itself as the stem, while the interior bottle-shaped part forms the head of the polype. However much these eggs at the first glance resemble the egg-capsules or fruit-depositors in one kind of *Sertularia*, I was confirmed in the opinion just expressed, partly because I could not observe any eggs within them, but chiefly on account of another observation which appears to me important. In some of the larger eggs, where the above-mentioned internal parts were particularly plain, I observed very evident, indeed powerful, movements; inasmuch as the egg, which seemed already to have reached its full maturity, alternately contracted and expanded itself quickly, and so by this systole and diastole endeavoured to disengage itself from the mother animal. I had no opportunity of observing the disengagement or the further development of it.'

"The language of the above observation is fanciful; but there can be no question of the accuracy of the statements.

"We found the *Corymorpha* in 10-fathom water, in a sandy bottom in the Bay of Stromness, Orkney. When placed in a vessel of sea-water, it presented the appearance of a beautiful flower. Its head gracefully nodded, (whence the appropriate specific appellation given it by Sars,) bending the upper part of its stem. It waved its long tentacula to and fro at pleasure, but seemed to have no power of contracting them. It could not be regarded as by any means an apathetic animal, and its beauty excited the admiration of all who saw it." *E. Forbes* and *J. Goodsir.*

II. SERTULARINA.

Ehrenberg *Corall. des roth. Meer.* p. 73.

Fig. 6.

FAMILY—SERTULARIADÆ.

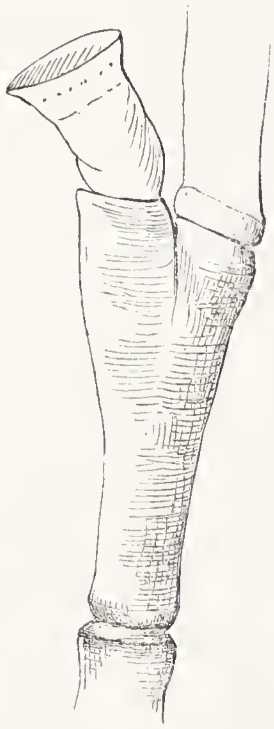
Genus SERTULARIÆ pars, *Pall.* Elench. 106. *Lin.* Syst. 1306. *Soland.* Zooph. 32.—SERTULARIEES, pars, *Lamour.* Expos. Meth. 9.—SERTULARIADÆ, pars, *Flem.* Brit. Anim. 538.—Les SERTULARIES, pars, *Blainv.* Actinolog. 472.—SERTULARIADÆ, *Johnston* in Trans. Berw. Cl. 107. *Gray* in Syn. Brit. Mus. 76.

CHARACTER.—*Polypidoms plant-like, horny, rooted, variously branched, tubular, filled with a semifluid organic pulp ; the polypes contained within sessile cells, which are variously, but always determinately, disposed along the sides of the main stalk or branchlets, and are never terminal : ova contained in horny deciduous vesicles scattered over the polypidom : embryos planaria-like.*

8. Halecium, Oken.*

Character.—*Polypidoms rooted, plant-like; the stem composed of aggregated subparallel capillary tubes; the branches alternate, spreading bifariously: cells tubular, subsessile, jointed at the base, arising alternately from opposite sides one under every joint of the branchlets: ovarian vesicles irregularly scattered.—Polypes hydraform, scarcely retractile within their cells.*

Fig. 7.



Halecium is very nearly allied to Laomedea. There is, however, a difference in the habit of their species, and the polype-cells are sessile or nearly so. These have been described as formed "like tubes with two joints." They consist of two portions,—one inserted in the parietes of the celliferous tube; and from this basal portion the other, which is the true cell, issues, being contracted and ringed at the root. (Fig. 7.)

1. H. halecinum, *vesicles oval or oblong, the aperture shortly tubulous, subterminal.* Jas. Newton.†

Plate VIII.

Corallina scruposa pennata, cauliculis crassiusculis rigidis, *Raii* Syn. i. 36, no. 15.—Herring-bone Coralline, *Ellis* in Phil. Trans. abridg. x. 454, pl. 10, fig. e. f. g.

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* "Halecium *Oken* Lehrb. Naturg. 1815. Halec." Agissiz in Nom. Zool. Polypi, p. 13. The genus is the same as the *Thoa* of Lamouroux, which, on the authority of Agassiz, we learn was not defined until 1816.

† Mr. James Newton, a good practical botanist, contemporary with Ray, to whom he sent many contributions for the Synopsis Stirpium Britannicarum, and the Hist. Plantarum. He died before the publication of the third edition of the Synopsis in 1724; but Dillenius acknowledges his obligations, and introduced several species into our Flora, for the first time, on Newton's authority. I am not aware that any genus of plants has been dedicated to his memory,—an honour of which he seems not unworthy. He must not be confounded with another James Newton, author of a "Compleat Herbal," Lond. 1752.

Coral. 17, no. 15, pl. 10. Phil. Trans. xlviii. 506, pl. 17, fig. f. E.—Sertularia halecina, *Lin.* Syst. 1308. *Pall.* Elench. 113. *Fabr.* Faun. Grœnl. 443. *Oliv.* Zool. Adriat. 288. *Ellis* and *Soland.* Zooph. 46. *Berk.* Syn. i. 217. *Esper* Pflanz. Sert. tab. 21, fig. 1, 2. *Turt.* Brit. Faun. 213. *Lam.* Anim. s. Vert. ii. 119 : 2de édit. ii. 146. *Flem.* Brit. Anim. 542. *Johnston* in Trans. Newc. Soc. ii. 259, pl. 12, fig. 2.—Thoa halecina, *Lamour.* Cor. Flex. 211. *Templeton* in Mag. Nat. Hist. ix. 468. *Blainv.* Actinolog. 488, pl. 84, fig. 4, 4, *a.* *Lamour.* Expos. Method. 14. *Hassall* in Ann. and Mag. Nat. Hist. vi. 167. *Couch* Zooph. Corn. 5. Corn. Faun. iii. 15, pl. 3.—Halecium halecinum, *Schweig.* Handb. 426.

Hab.—On old shells and stones in deep water, common.

Polypidom from 4 to 10 inches high, fixed by numerous fibres "irregularly matted together like a piece of sponge," of an earthy-brown colour, stiff, brittle when dry, irregularly branched, the stem, and principal branches composite, tapered upwards, pinnate ; the pinnæ alternate, patent, simple, jointed, and incrassated at the joints where the cells are placed. These arise alternately from opposite sides, one just below each joint ; they are subsessile, with a joint at the base, of a tubular or rather deeply campanulate form with a plain slightly everted rim, and of such a thin membranous texture that they are rarely found entire on dried specimens or on such as have been driven on shore by storms. Vesicles unilateral, scattered, of an oval shape, "with a tube arising from the pedicle, and passing up on one side to a little above the top of each." *Ellis.* Young specimens are often partially coloured a bright yellow, dependent apparently on the colour of the interior pulp.

2. H. Beanii, *vesicles calceoliform, the aperture subcentral, shortly tubulous.* William Bean.

Plate IX. Fig. 1, 2.

Thoa Beanii, *Johns.* Brit. Zooph. 120, pl. 7, fig. 1, 2. *Thompson* in Ann. Nat. Hist. v. 250. *Hassall* in Ann. and Mag. N. Hist. vi. 167.

Hab.—"Near Scarborough, in deep water, very rare," *W. Bean.* "Procured by dredging in Belfast Bay, where it in some situations takes the place of *T. halecina.* Before it was described as a distinct species, its peculiarities, independently of the remarkable ovaries, were noticed by Mr. Hyndman and myself—its general aspect or habit first attracted our attention. Instead of the rigid 'herring bone' appearance of *T. halecina,* it is somewhat flexible and graceful." *W. Thompson.* Dublin Bay, *A. H. Hassall.* "Among zoophytes collected in Dublin Bay by W. H. Harvey, Esq., in 1834,

and kindly sent to me, were examples of this species. Adherent to oysters dredged at Killough, co. Down." *W. Thompson.*

Polypidom $1\frac{3}{4}$ inch high, irregularly branched, the branches alternate, spreading, the principal composed of many parallel tubes, the ultimate of a single tube, with a joint between each cell, which is small, articulated, cylindrical or somewhat dilated at the aperture. Vesicles numerous, scattered or imperfectly clustered, large and shaped somewhat like the flower of a Calceolaria, with a short tubulous aperture in the middle of its concavity, which is on the superior and inner aspect.

I have named this curious and very interesting species after its discoverer, to whose kindness I am indebted for the specimen that furnished our figure and description. In habit and structure it closely resembles H. halecinum ; from which it is, however, at once distinguished by its remarkable ovaries.

3. H. MURICATUM, *vesicles roundish or ovate, echinated.* Dr. David Skene.

PLATE IX. FIG. 3, 4.

Sertularia muricata, *Ellis* and *Soland.* Zooph. 59, pl. 7, fig. 3, 4. *Esper* Pflanz. Sert. tab. 31, fig. 1, 2. *Don's* Pl. and Anim. of Forfar, 36. *Turt.* Brit. Faun. 215. *Jameson* in Wern. Mem. i. 564. *Flem.* Brit. Anim. 543. *Hogg's* Stockton, 34. —Laomedea muricata, *Lamour.* Cor. Flex. 209.—Campanularia muricata, *Blainv.* Actinol. 473.—Thoa muricata, *Couch* Zooph. Corn. 5. Corn. Faun. iii. 16. *Macgillivray* in Ann. and Mag. N. Hist. ix. 463.

Hab.—On old shells in deep water. The sea at Aberdeen, *Skene.* Angusshire, *Mr. Don.* Frith of Forth, *Jameson.* Seaton, *J. Hogg.* Near Scarborough, *W. Bean.* Near Dundee, *W. Jackson, jun.* Coast of Cornwall, rare, *Couch.* Giant's Causeway, *A. H. Hassall.*

Polypidom from 2 to 4 inches high, rooted by a fibrous entangled mass, irregularly branched, stout and rigid, yellowish-brown ; the stem and branches composed of capillary tortuous tubes closely agglutinated, but the extremities of some of them become free and appear like simple fibres ; branches erecto-patent, slightly tapered at the point. Cells visible only on the simple fibres, small, alternate, separated by an oblique joint, sessile, campanulate, with an entire even aperture. Vesicles very numerous and often crowded, shortly stalked, roundish or ovate, somewhat compressed, and rough with prickles arranged in lines on elevated striæ : when filled with ova, the centre is of a deep chesnut-brown colour.

May not the obscure Sertularia echinata of Linnæus be referable to this species?

9. Sertularia,† Linnæus.

Character.—*Polypidom growing in the shape of a plant and fixed by its base, variously branched, the divisions or branches formed of a single tube denticulated or serrated with the cells, and jointed at regular intervals: cells alternate or paired, biserial, sessile, urceolate, short with everted apertures: ovarian vesicles scattered.—Polypes hydraform.*

* Cells alternate, one to each internode.

1. S. polyzonias, *loosely branched, the branches patent, subflexuous; cells alternate, urceolate, with a wide everted four-toothed aperture; vesicles nearly egg-shaped and wrinkled across.* Jas. Newton.

Var. α. Frondose, diffuse. Pl. x. fig. 1.
Var. β. Caulescent, pinnate. Pl. x. fig. 2.

Plate X. Fig. 1—3.

Corallina minus ramosa, alterna vice denticulata, *Raii* Syn. 35, no. 13, tab. 2, fig. 4.—Great Tooth Coralline, *Ellis* Corall. 5, no. 3, pl. 2, fig. *a A*, *b B*, and pl. 38, fig. 1 *A*.—Corallina pennata et siliquata, ab ostreo abstracta, *Bast.* Opusc. i. 42, pl. 2, fig. 7. pessima.—Sertularia polyzonias, *Lin.* Syst. x. 813. *Lin.* Syst. 1312. *Ellis* and *Soland.* Zooph. 37. *Berk.* Syn. i. 219. *Esper* Pflanz. Sert. tab. 6, fig. 1—6. *Oliv.* Zool. Adriat. 290. *Turt.* Gmel. iv. 683. *Blumenb.* Man. 273. *Turt.* Brit. Faun. 216. *Jameson* in Wern. Mem. i. 564. *Stew.* Elem. ii. 447. *Lam.* Anim. s. Vert. ii. 117: 2de édit. ii. 142. *Lamour.* Cor. Flex. 190. *Risso* l'Europ. Mérid. v. 130. *Bosc* Vers. iii. 119. *D. Chiaie* Anim. s. Vert. Nap. iv. 141. *Hogg's* Stock. 31. *Flem.* Brit. Anim. 542. *Johnston* in Trans. Newc. Soc. ii. 256. *Templeton* in Mag. Nat. Hist. ix. 468. *Blainv.* Actinolog. 480. *Hassall* in Ann. and Mag. Nat. Hist. vi. 167. *Couch* Zooph. Corn. 6; Corn. Faun. iii. 17.—Sertularia flexuosa, *Lin.* Syst. x. 814, no. 34.—Sertularia ericoides, *Pall.* Elench. 127. *Esper* Pflanz. Sert. tab. 12, fig. 1, 2.—Sertolara polizonia, *Cavol.* Polip. mar. 224, tav. 8, fig. 12-14.—Sertularia Gayi, *Lamour.* Expos. Method. 12, tab. 66, fig. 8, 9. (var. β.) Fig. bona.—Sertularia pinnata, *Templeton* in Mag. Nat. Hist. ix. 468. (var. α.) *Thompson* in Ann. Nat. Hist. v. 250.—Sertularia hibernica, *Johns.* Brit. Zooph. 128.—Sertularia Ellisii, *M. Edwards* in Lam. Anim. s. Vert. 2de édit. ii. 142. *Johns.* Brit. Zooph. 123. *Couch* Zooph. Corn. 6; Corn. Faun. iii. 17.

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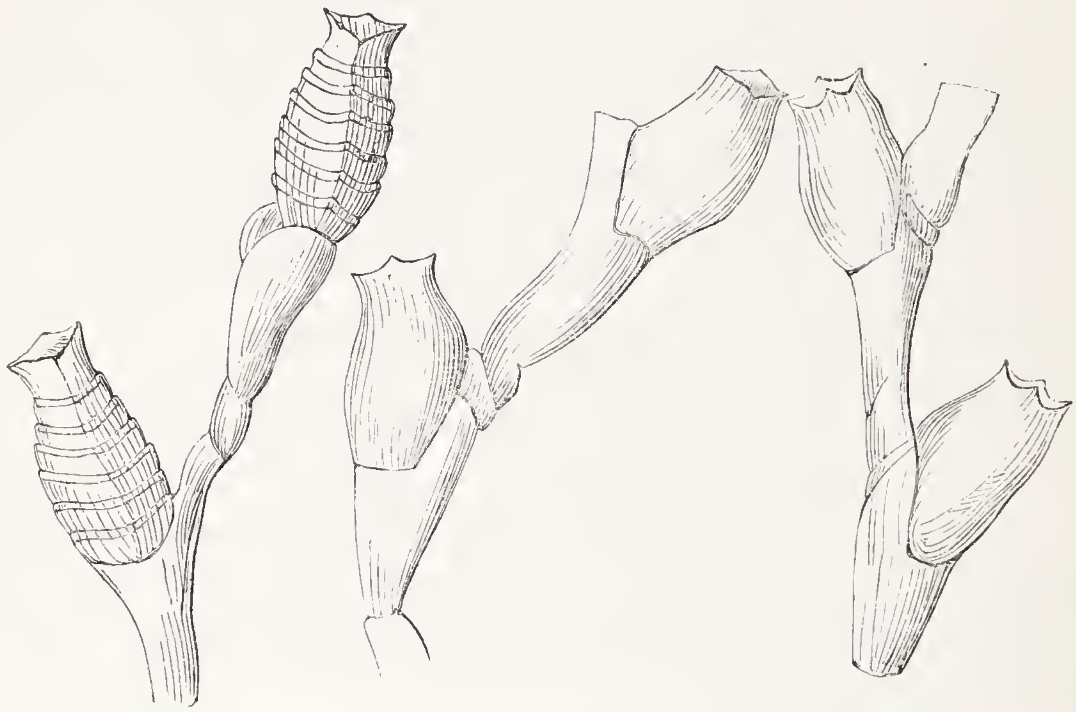
† From *sertula*, the diminutive of *serta*, a garland.

Hab.—On shells and other corallines; and on sea-weeds, common.

Fig. 8.



Polypidom affixed by a creeping tubular fibre, from one to four, or even six, inches high, sparingly and diffusely branched in general, the shoots filiform and slender, scarcely zigzag, jointed at regular intervals, the interarticular spaces dilated upwards, the joints consisting of one or two oblique twists or wrinkles. The cells are situated at and under the joints; they are alternate and rather distant, sessile, urceolate, short, bulged at the base, the upper half free and divergent, smooth, with a wide aperture looking outwards and having its rim sinuated with four small denticles placed at equal distances. (Fig. 8, *a*, *b*.) Polypes white or sometimes bright yellow, with numerous tentacula. Vesicles large, sessile, ovate, with a short tubulous apex, generally wrinkled across, sometimes smooth. After the ova have escaped from it, the orifice of the vesicle is rendered slightly spinous or toothed.

Pallas describes a variety (β.) worthy of notice, not unfrequent on the coast of Cornwall, three inches and upwards in height, with a compound stem, and branched in a pinnate manner similar to Halecium halecinum, which this variety indeed very closely resembles. Ellis mentions that he had received specimens of the same from the Isle of Wight: and I have found it on the coast of Berwickshire. In the collection of my friend Dr. Coldstream, there are specimens also from the Cape of Good Hope, of a still greater size and more robust

and shrubby habit, with numerous compound branches,—evidencing the genial influence of climate on the growth and appearance of these corallines.

In an examination of an extensive series of specimens, I have found a considerable variety in the form of the cells and in the degree of contraction at the aperture, and this even in the same specimen, so that I am now led to regard M. Edwards' attempt to draw a distinction between the specimens figured by Ellis as fruitless and unnecessary, and this conclusion I find confirmed by the experience of Mr. W. Thompson and Mr. Peach.* The denticles on the rim of the aperture are sometimes obscure, or even wholly absent; and I have seen specimens in which there was no joint between the cells, but the tube was even and continuous, as represented by Ellis in pl. 38. Smooth and strongly wrinkled ovaries have also occurred on the same polypidom. Mr. Thompson says, "All the specimens, from various localities, in my collection, whether growing in a flexuous or erect form, winding round the stems of algæ, or expanding in an arborescent manner from a single base, have both cells and vesicles toothed. I have not seen any vesicles with an even orifice, as represented in the erect state of the species by Ellis."

In the collection of the British Museum, I saw our var. *α.* named *Sert. denticulata* by Colonel Montagu; and our var. *β.* was his *Sert. polyzonias.* The latter again is very well described and figured by Lamouroux, under the name of *Sert. Gayi.*

Esper's figures are not good, but still there can be no doubt that they represent this species.

2. S. RUGOSA, *cells ovate, wrinkled transversely, the mouth narrow, with four small teeth on the rim.* Ellis.

PLATE X. FIG. 4—6.

Snail trefoil Coralline, *Ellis* Corall. 26, no. 23, tab. 15, fig. *a*, A.—Sertularia rugosa, *Lin.* Syst. 1308. *Pall.* Elench. 126. *Ellis* and *Soland.* Zooph. 52. *Fabr.* Faun. Grœnl. 443. *Esper* Pflanz. Sert. tab. 11, fig. 1—4. *Lam.* Anim. s. Vert. ii. 121 : 2de édit. ii. 149. *Flem.* Brit. Anim. 542. *Johnston* in Trans. Newc. Soc. ii. 257, pl. 11, fig. 3. *Couch* Zooph. Corn. 6 ; Corn. Faun. iii. 18.—Clytia rugosa, *Lamour.* Cor. Flex. 204. *Templeton* in Mag. Nat. Hist. ix. 466.—La Campanulaire rugueux, *Blainv.* Actinol. 473.

Hab.—Parasitical on Flustræ, Sponges, and Fuci at low-water mark, common.

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* Mr. Thompson has seen Ellis' specimens, and he is of opinion that they belong to Sert. polyzonias. The figures in Ellis' work admirably represent the specimens.

A small species not exceeding an inch in height, and well distinguished by its strongly wrinkled cells, which resemble a barrel in miniature. Polypidoms gregarious, the shoots united by a radical branching fibre, erect or creeping, annulated between the cells, simple or sparingly branched, the branches irregular, patent. Cells crowded, alternate, subsessile, ovate, coarsely wrinkled, especially when dried, contracted at the orifice which is obsoletely quadridentate. The ovarian vesicles are sparingly evolved, and differ from the cells only in being a little larger, and in having three teeth in the opening at the top of each. As a parasite, it does not confine itself to Flustra foliacea, as Pallas would have us to believe; but infests the roots and stems of many sea-weeds.

There is a variety of this species, parasitical on Plumularia falcata, which, in habit and in the remoteness of the cells, resembles Sert. polyzonias. The cells are also more cylindrical or ovate than ordinary. The constantly submerged state in which this variety grows may account for its peculiarities, which certainly bring it very near to the figure of Sert. polyzonias in Ellis, pl. 2, fig. *A*, but from which it is distinguished by the coarsely wrinkled cells. (Fig. 8, *c*.)

The *Sert. patagonica* of D'Orbigny does not appear to be distinct from S. rugosa. Mr. W. Thompson has specimens, on algæ, from California.

** Cells in pairs, opposite or semi-alternate.

3. S. ROSACEA, *cells opposite, tubulous, the upper half free and divergent, the aperture entire, truncate; vesicles crowned with spines.* Ellis.

PLATE XI. FIG. 1.

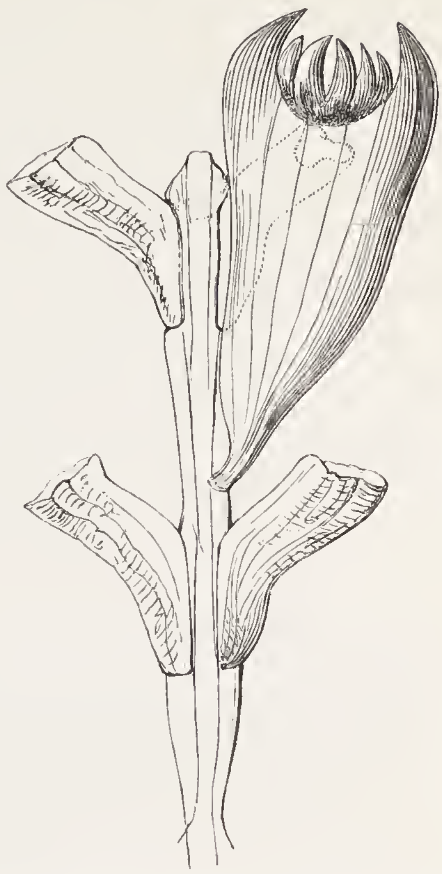
Lily or Pomegranate-flowering Coralline, *Ellis* Corall. 8, no. 7, pl. 4, fig. *a. A.* Phil. Trans. abridg. x. 492, pl. 12, fig. 5, s.—H.——Sertularia rosacea, *Lin.* Syst. 1306. *Ellis* and *Soland.* Zooph. 39. *Esper* Pflanz. Sert. tab. 20, fig. 1—3. *Lam.* Anim. s. Vert. ii. 119. *Johnston* in Trans. Newc. Soc. ii. 258. *Templeton* loc. cit. 468. *Couch* Zooph. Corn. 7; Corn. Faun. iii. 18. *Macgillivray* in Ann. Nat. Hist. ix. 463.—Sert. nigellastrum, *Pall.* Elench. 129.—Sert. abietina? *Fabric.* Faun. Grœnl. 442.—Dynamena rosacea, *Lamour.* Cor. Flex. 175. *Flem.* Brit. Anim. 544.

Hab.—Frequent on corallines, and occasionally on old shells from deep water.

Polypidom from one to two inches in height, attached by a creeping tortuous tubular fibre, very slender and delicate, of a white or

pale horn colour, pellucid, variously branched, the branches bifarious, alternate, patent, similar to the stem. Cells opposite, with a joint between each pair, rather long, tubular, creased, the upper half suddenly divergent, with an oblique entire wide aperture. (Fig. 9.) The internodes are often much constricted at the joint, which is sometimes apparently twisted. Ellis compares the vesicles to a "Lily or Pomegranate flower just opening," but Pallas asserts that the comparisons, as well as the figures of them in Ellis's work, are inaccurate, —a criticism the truth of which Ellis denies in his subsequent volume on zoophytes. They appear in fact to vary somewhat according to their age, and also from the manner in which they have been dried, for, from the thinness of their texture, they are more liable than in other species to become creased and folded irregularly. In general they are subsessile and very exactly pearshaped, with a lanceolate segment on each side, the segments converging and partially covering the puckered centre, like the leaves of a cabbage round its heart (fig. 9.); but there is considerable variety in their figure and structure. Pallas says that they are hexangular, and have six subulate and patent spines above, so as to resemble the capsules of the Nigellæ. In some good specimens sent to me by Mr. Peach from Cornwall, the capsules are not only considerably smaller than usual, but the acute apex is entire in some cells, and in others furnished with one or two minute spines. These capsules are probably immature, and have not yet opened to discharge their contents.

Fig. 9.



Sert. rosacea, according to Mr. W. Thompson, "is much more delicate and graceful when springing from the stems of its kindred zoophytes (Sertularia argentea, Plumularia falcata, &c.) than from those of the tangle (Laminaria digitata): the colour, too, is lighter and of a more agreeable hue in the former instance. In the same locality (Belfast bay) it differs thus, accordingly as it emanates from zoophytes or the Laminaria. The more robust development of S.

rosacea on the stems of this fucus reminds me of the equally greater development of an alga—Ptilota plumosa—upon its stems than when springing from a rock. In so far as specimens have come under my observation, each of the two states of the zoophyte is as permanent, according to the object on which it is based, as in the case of the sea-weed. The vesicles, too, differ :—those of S. rosacea based on a zoophyte are admirably represented by Ellis."

Though scattered over the polypidom, the vesicles appear to be produced from one side only, and are often arranged in close rows along the branches.

4. S. PUMILA, *cells opposite, approximate, shortly tubular, the top everted with an oblique somewhat mucronated aperture; vesicles ovate.* S. Doody.*

PLATE XI. FIG. 3, 4.

Corallina pumila repens, minus ramosa, *Raii* Syn. i. 37, no. 19.—C. pumila erecta, ramosior, *Ibid.* 37, no. 20, pl. 2, fig. 1.—Muscus marinus lendigenosus minimus arenacei coloris, *Morris.* Plant. hist. iii. 650, tab. 9, fig. 2.—*Reaumur* in Mem. de l'Acad. Roy. des Sc. an. 1711, 394, pl. 11, fig. 4, M.—Sea-oak Coralline, *Ellis* Corall. 9, no. 8, pl. 5, fig. *a*, A. Phil. Trans. xlviii. 632, pl. 23, no. 6. Phil. Trans. lvii. 437, pl. 19, fig. 11. Phil. Trans. abridg. x. 493, pl. 12, fig. 6, F.—Sertularia pumila, *Lin.* Syst. 1306. *Pall.* Elench. 130. *Ellis* and *Soland.* Zooph. 40. *Esper* Pflanz. Sert. tab. 10, fig. 1, 2. *Oliv.* Zool. Adriat. 288. *Stew.* Elem. ii. 441, pl. 12, fig. 10, 11, copied from Ellis. *Lam.* Anim. s. Vert. ii. 119 : 2de edit. ii. 145. *Stark* Elem. ii. 440, pl. 8, fig. 14. from Ellis. *Johnston* in Trans. Newc. Soc. ii. 259. *Lister* in Phil. Trans. an. 1834, 371, pl. 8, fig. 3. *Templeton*, lib. cit. 468. *Hassall* in Ann. and Mag. Nat. Hist. vii. 284, pl. vi. fig. 5. *Couch* Zooph. Cornw. 7 : Corn. Faun. iii. 19.—Sertolara pumila, *Cavol.* Pol. mar. 216, tav. 8, fig. 8-10.—Dynamena pumila, *Lamour.* Cor. Flex. 179. *Flem.* Brit. Anim. 544. *Blainv.* Actinol. 484.—Sertolara piccina, *D. Chiaie* Anim. s. Vert. Nap. iv. 142.—*Krauss* Corall. and Zoophyt. der Sudsee, 28.

Hab.—Near low-water mark very common, parasitical on various Fuci, particularly F. vesiculosus, serratus, and nodosus.

* Doody, Samuel, an apothecary in London, contemporary with Ray, Petiver, and Sloane ; admitted F.R.S. in 1695. He was chosen Superintendant and Demonstrator of the garden at Chelsea, an office which he held for some years previous to his death, which took place in 1706. Petiver characterises him as an "indefatigable botanist" and "memorable naturalist." Jussieu speaks of him as "inter Pharmacopœos Londinenses sui temporis Coryphæus." Pulteney styles him "the *Dillenius* of his time ;" and Brown has crowned his praise by bestowing his name on a genus of New Holland plants. "In memoriam dixi Samuelis Doody, Pharmacopœi Londinensis, qui primus fere in Anglia plantas cryptogamicas investigavit."—Prod. Flor. Nov. Holl. p. 7. See also Pulteney's Sketches, v. ii. p. 107-9.

The polypiferous shoots originate from a slender tubular thread which creeps along the surface of the fucus, and connects them all together. The shoots are very numerous, often covering a considerable space of the sea-weed, seldom more than half an inch in height, of a dusky horn colour, and thickish texture, sparingly branched, filiform, flattish, serrated with the cells, which are divided usually into pairs by a dissepiment or joint, but sometimes there are four cells between the constricted separations. The polypes have 14 tentacula, and when the animal displays them, it at the same time extrudes the body far beyond the rim of the cell.* The vesicles are copiously produced during the summer months, and are irregularly distributed over the branches : they are subsessile, ovate with a short tubulous rim, smooth, or sometimes wrinkled circularly : in the centre a placentular column is at seasons obvious, and in June I have found them filled with innumerable pellucid granules floating in an amniotic liquor.

Mr. C. W. Peach has sent me a very pretty and delicate variety, which he finds on the coast of Cornwall and of Norfolk. It appears to owe its delicacy to the circumstance of growing in deep water. Mr. W. Thompson sends another variety (dredged in Dublin bay by W. H. Harvey), which imitates the early state of S. argentea. It has a flexuous percurrent rachis with numerous erecto-patent branchlets, which seem to be mostly opposite at their insertions. The cells are smaller than usual and more remote, but do not offer any other peculiarity.

5. S. Evansii, "*has opposite branches, and short denticles placed opposite to each other ; the ovaries are lobated, and arise from opposite branches, which proceed from the creeping adhering tube.*" Mr. John Evans.†

Sertularia Evansii, *Ellis* and *Soland.* Zooph. 58. *Lam.* Anim. s. Vert. 2de edit. ii. 154.—Dynamena Evansii, *Lamour.* Cor. Flex. 177. *Flem.* Brit. Anim. 545.

Hab.—" Among some sea productions brought from Yarmouth, in Norfolk, in the year 1767." *Ellis.*

" This coralline is about two inches high, very slender, and of a

* " The number of tentacula in this species is not very constant, but usually about 16." *A. H. Hassall.*

† Ellis calls him " a sea-officer in the East India Company's service." Probably the same Mr. Evans, a surgeon, whom Petiver mentions amongst the contributors to his museum.

bright yellow colour. It creeps on fucus's. The ovaries differ from all the rest of the genus : they are lobated, and the lobes are placed opposite to one another : these appear to be full of spawn, of a deep orange colour, which is sent forth from holes at the end of the lobes." *Ellis.*

6. S. NIGRA, *pinnate, blackish ; cells opposite or subalternate, adherent, tubulous, with a plain rim ; vesicles large, unilateral, pearshaped.* Pallas.

PLATE XII. FIG. 1, 2.

Sertularia nigra *Pall.* Elench. 135. *Couch* Zooph. Corn. 8 : Corn. Faun. iii. 20, pl. 6.

Hab.—Ad Promontorium Lacertæ, Cornubiæ, reperitur, *Pallas.* " Though not so generally diffused as many others, it is far from being uncommon in particular localities. Off the Deadman-point it is found, though rarely ; at a few miles west and north-west of the Eddystone lighthouse it is common, and from that locality I have obtained some exceedingly fine specimens, which, from January to May, have abounded in ovarian vesicles," *R. Q. Couch.* Devonshire, *Mrs. Griffiths.*

Polypidom robust and erect, from three to six or even eight inches in height, pinnate, somewhat lanceolate, of a blackish-brown colour when dried, sometimes partially tinted with red, varnished. Root-fibres tortuous and wrinkled, entangled, anastomosing, rising up on the rachis sometimes to the origin of the pinnæ. Rachis simple, straight, and firm, sensibly tapered towards the top, compressed, jointed at short and pretty regular intervals, and denticulated up the sides : Pinnæ originating from the flattish sides by a narrow base, linear, often very much elongated, mostly alternate but sometimes opposite, serrated : Cells (fig. 10, *a*) small, crowded, opposite, or semi-alternate, biserial and lateral, tubulous, adnate, the upper half scarcely free and very slightly everted, the aperture wide and even : Vesicles large and numerous, produced from the upper edge of the pinnæ, and hence ranged in a line : they are subsessile, smooth, and varnished, pear-shaped, divided into four equal parts by longitudinal dissepiments meeting on the apex, which is sometimes obtuse and sometimes rather acute and of a pitchy-black colour. " This form of the vesicle is rarely observed except when it has arrived at perfection, but in a less advanced state the upper portion is flat, and the circumference irregularly lobulated." *R. Q. Couch.*

" This species, as it is seen in collections, is of a dark or black-

Fig. 10.

brown colour, from which it derives its specific name ; but to see it in all its beauty it must be examined in a living state, and soon after it is taken from the sea ; when, instead of being black, it will be found of a beautiful and delicate pink, and in some instances of a deep arterial blood colour. It is the stoutest and most rigid of all our native Sertulariæ, but there are several others which exceed it in beauty and delicacy." *R. Q. Couch.*

7. S. PINNATA, *pinnate, reddish-brown ; cells subalternate, tubular, adherent, with a plain rim ; vesicles unilateral, rather small, the top surrounded with a series of denticles.* Pallas.

PLATE XII. FIG. 3, 4.

Corallina abietis forma, *Bast.* Opusc. Subs. i. 41, tab. 1, fig. 6 (bad).—Sertularia pinnata, *Pall.* Elench. 136.—S. fuscescens, *Turt.* Gmel. iv. 677. *Turt.* Brit. Faun. 213. *Lamour.* Cor. Flex. 195.

Hab.—" Oceanus ad Prom. Lacertæ, Cornubiæ," *Pallas.* Coast of Devonshire, *Mrs. Griffiths.*

I am indebted for a good specimen of this species to Mrs. Griffiths, who mentions that, when fresh, it was entirely deep blood-red. When dried it is a clear dark brown, with many pinnules of the usual light horn colour. There is the closest resemblance,—"affinitas summa," as Pallas expresses it,—between it and S. nigra, which it equals in size, but is a little slenderer. The real distinction between them lies in the position of the cells, and in the form

of the vesicles. The former arise not from the sides exactly, but rather on the edge of the pinnules, ("in alterum stirpis latus vergentes,") and this character is obvious enough with a good magnifier : the latter are comparatively small, ob-conical, with a series of tubercles or segments above, while the centre projects in the shape of a cone or nipple open on the top. (Fig. 10, *b.*) The cells are semialternate, appressed, the upper portion scarcely everted, the mouth wide with a plain rim usually sinuated next the side of the rachis.—The description which Mr. Couch has given of the immature vesicle of S. nigra applies to the vesicle of this species.

8. S. FUSCA, *pinnate, blackish ; pinnæ filiform ; cells very small, appressed, tubular, four-rowed ; vesicles pearshaped, smooth.* Robert Brown.*

Fig. 11.

WOODCUT, No. 6, ON PAGE 57 : AND FIG. 11.

Sertularia nigra, *Jameson* in Wern. Mem. i. 565. *Johns.* Brit. Zooph. 128. *Macgillivray* in Ann. Nat. Hist. ix, 463.—Dynamena nigra, *Flem.* Brit. Anim. 545.

Hab.—Coast of Aberdeenshire, *R. Brown.* Coast of Northumberland at Dunstanborough Castle, from deep water, *R. Embleton.* Scarborough, *W. Bean.* Whitburn, co. Durham, *Miss M. Dale.*

* The author of the "Prodromus Floræ Novæ Hollandiæ."

Polypidom three inches high, rigid, pinnate, lanceolate, dusky or blackish-brown, varnished. Stalk straight, roundish, jointed, with a series of alternate cells on each side : pinnæ alternate, close, bifarious, several originating from each space between the joints of the stalk, simple, narrow at their origins, filiform, or almost insensibly incrassated upwards, often gangrened at the apex. The cells are arranged in a close row along each margin, and directed alternately to opposite sides, so that they are almost quadrifarious, and the pinna is hence quadrangular : they are very small, tubular, short and adnate, with a wide mouth having a small tooth on the outer edge. (Fig. 10, *c.*) Vesicles unilateral, superior, pearshaped, subpedicellate, smooth. (Fig. 11.)

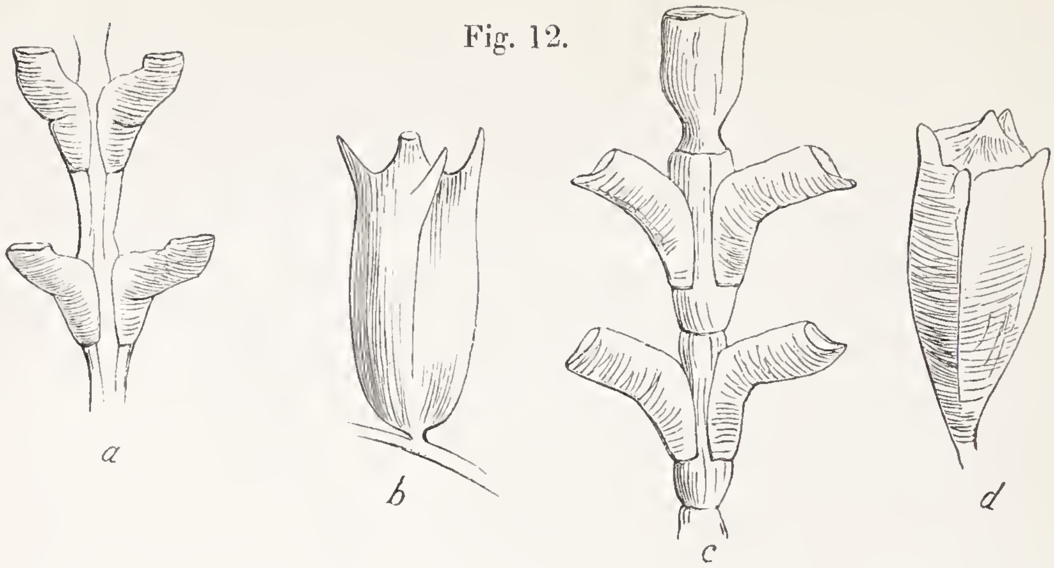
9. S. PINASTER, *pinnate ; cells in opposite pairs, tubular, the upper half divergent, with a plain rim ; vesicles oval, quadrangular above, with a mucro at each angle on the top, and in the middle a little tubulous opening.* W. Thompson.

Sertularia pinaster, *Ellis* and *Soland.* Zooph. 55, tab. 6, fig. 6, B. *Rees* Cyclop. Vermes, pl. 8, fig. 4. *W. Thompson* in Ann. Nat. Hist. x. 23 ; and in Rep. Brit. Assoc. 1843, 283.—Dynamena pinaster, *Lamour.* Expos. Meth. 12, tab. 6, fig. *b.* B.

Hab.—"This species exactly as represented by Ellis, and bearing vesicles, has been dredged by Mr. Hyndman at the entrance to Belfast bay. By similar means this gentleman obtained it on two occasions from a depth of 40 fathoms off Sana Island on the western coast of Scotland ; but the few examples were without vesicles, as was a single specimen dredged off the Mull of Galloway by Captain Beechey, R.N., from a depth of 110 to 140 fathoms. In some instances, a single plume ; in others, several plumes spring from the same base. The branches are more produced than represented by Ellis and Solander ; and in one specimen secondary branches are thrown out, as we see in luxuriant examples of its near allies, S. abietina and S. filicula." *W. Thompson.*

Polypidom affixed by a creeping fibre, three or four inches in height, pinnate, simple or with irregular shoots that appear rather to grow *on* the rachis of another than to grow *out* of it : rachis straight, serrulate, often plain towards the base, dusky or horn-coloured, compressed : pinnæ alternate, simple, rarely compound, patent : Cells geminate, tubular, the lower half adhering close to the stalk, the upper portion suddenly divergent, bent upwards so as to be somewhat concave on the superior side, while there is a sort of fold

Fig. 12.



under the angle of divergence, the aperture plain, sinuated on the proximal margin (Fig. 12, *a.*) : Vesicles produced from the upper side of the pinnæ, oval, truncate above, and quadrangular, with a spine produced above from each angle, the opening central and papillous. (Fig. 12, *b.*)

There is a slender variety with the free portion of the cells more elongated than usual, so that they resemble considerably those of S. rosacea, from which it cannot be easily distinguished except by an examination of the ovarian vesicles. (Fig. 12, *c, d.*)

10. S. Margareta, *pinnate ; cells nearly opposite, tubular, the upper half elongate, free and divergent, with a wide plain aperture ; " vesicles four-sided, armed with eight long teeth."* R. A. Tudor.

Sertularia Margareta, *Hassall* in Ann. and Mag. Nat. Hist. vii. 284, pl. vi. fig. 3, 4.

Hab.—Mouth of the Mersey, Cheshire, *Mr. Tudor.* " Dredged up off Howth, sparingly ; also found near the Giant's Causeway," *A. H. Hassall.* Collected by William H. Harvey, Esq., in Dublin Bay, in 1834, *W. Thompson.** Devonshire, *Mrs. Griffiths.*

Polypidom adhering by tortuous tubular fibres, and rising, usually in a graceful bend, to a height of three or four inches, of a pale horn colour, darker near the base and in the stalk, pinnate, the rachis straight, celliferous, the pinnæ rather close, regularly alternate, patent, simple : Cells opposite or nearly so, three in the intervals between the origins of the pinnæ, two or three pairs between their joints, tubular, the upper half free and divergent, curved on the upper side, with a wide unconstricted aperture, the texture thin and smooth.

* Mr. Thompson sent me specimens in March 1839, but the doubts I had expressed of the species prevented its being then named as distinct.

Fig. 13.

Allied in texture, habit, and in the shape of the polype-cells to the preceding species, from which it differs in having vesicles considerably larger, of an ovate figure, rounded at the top, and armed with eight spines (fig. 13.), arranged in two circles, — one at the top, and the other towards the middle. It may be doubted whether this forms a good specific distinction, seeing how variable the vesticles are in S. rosacea, and other species.

"To this new and interesting species I have assigned the Christian name of a lady, distinguished not only for an ardent love of the works of nature, but as a zealous collector in various branches of natural history on these shores."—*A. H. Hassall.*

With respect to the discovery of this Sertularia, I feel it necessary to state that specimens were sent to me from Mr. Tudor, through my ardent friend, Mr. T. G. Rylands, of Bewsey-House, many months previously to its publication by Mr. Hassall. Mr. Rylands had bestowed upon the species the name of *Sert. Tudori;* and when I suggested to him the possibility of its proving to be a robust state of Sert. rosacea, he immediately, and in detail, pointed out their diagnostick marks. As, however, the vesicles were wanting in all Mr. Tudor's specimens, we waited the chance of finding one with them before publishing a description; and in the mean time fortune gave that chance to Mr. Hassall, whose knowledge of the tribe at once taught him to discern the peculiarities by which it is characterised.

11. S. FALLAX, *pinnate, the pinnæ alternate; cells in pairs, opposite, tubular, the upper part free and divergent, with an even patulous aperture: vesicles ovate, four-cleft.* Rev. J. Fleming.

PLATE XI. FIG. 5, 6, 2.

Dynamena pinnata, *Flem.* Brit. Anim. 545.—Sertularia pinnata, *Johns.* Brit. Zooph. 127, pl. 9, fig. 5, 6. *Macgillivray* in Mag. Nat. Hist. ix. 463.—Dynamena tubiformis? *Lamour.* Expos. Meth. 12, pl. 66, fig. 6, 7.

Hab.—"On oyster-beds, common," *Fleming.* Frith of Forth, plentifully, *Dr. Coldstream.* Coast of Northumberland, near Dunstanborough, *R. Embleton.* Whitburn, *Miss M. Dale.* Scarborough, *W. Bean.* Coast of Aberdeen, *J. Macgillivray.*

Polypidom attached by tortuous tubular fibres, from two to four inches in height, pinnated with alternated branches, the rachis usually of a blackish or dusky horn colour, with a slight gloss on the surface, rather rigid when dry, straight, flattish, jointed, with a pair of opposite cells on each interspace, pinnæ spreading, mostly simple, jointed like the stem : Cells tubular, the upper portion free, erecto-patent, with a wide aperture, often sinuated on the proximal margin, and girded with two or three faint circular wrinkles : Ovarian vesicles large, pear-shaped, of a thin membranous texture, with the top cut into four deep convergent lanceolate segments. The immature vesicles are truncate above and entire, as if the segments were folded inwards.

12. S. TAMARISCA, *cells opposite, tubular, the upper half divergent with a wide aperture sinuated on the margin ; vesicles oval, truncate, with two small points at the corners and a tubulous mouth.* Ellis.

PLATE XIII. FIG. 2, 3, 4.

Sea Tamarisk, *Ellis* Corall. 4, no. 1, pl. 1, fig. *a*, A.—Sertularia tamarisca, *Lin.* Syst. 1307. Pall. Elench. 129. *Ellis* and *Soland*, Zooph. 36. *Oliv.* Zool. Adriat. 288. *Don's* Pl. and Anim. of Forfar, 36. *Lamour.* Cor. Flex. 188. *Lam.* Anim. s. Vert. 2de edit. ii. 153. *Hassall* in Ann. Nat. Hist. vi. 168. *Couch* Zooph. Corn. 8 : Corn. Faun. iii. 21.—Dynamena tamarisca, *Flem.* Brit. Anim. 543.

Hab.—On old shells in deep water, not common. Near the island of Dalkey, at the entrance of the harbour of Dublin, *Ellis.* Belfast lough, *J. Templeton.* Ballycastle, co. Antrim, *Dr. J. L. Drummond.* Howth, co. Dublin, *R. Ball.* Portmarnock, on the same coast, *W. Thompson.* Near Aberdeen, *Dr. David Skene.* Angusshire, *Mr. Don.* Frith of Forth, *Dr. Coldstream.* Very rare at Scarborough, *Mr. Bean.* Bootle coast, rare, *Mr. Tudor.* Cornwall, rare, *R. Q. Couch.* "Very rare, but very fine indeed, in Fowey harbour ; Paignton, Devon ; and Norfolk," *C. W. Peach.*

Polypidom from four inches to "sometimes nearly a foot," in height, rooted by a creeping vermicular fibre, stout and erect, denticulated throughout, bifariously branched, the branches commonly

alternate, rather distant, either simple or semipennated with secondary shoots. The cells are of a thin transparent corneous texture, large, smooth, exactly opposite, in approximated pairs, divided by a strictured joint, the upper half free and divergent, and the margin of the aperture uneven and obsoletely tridentate. Vesicles large, unilateral, scattered, obcordate or pyriform with a tubular aperture. It seems that the little spine on each side is dependant on the age of the vesicle, and not perceptible when this is young. When mature it is filled with orange-coloured ova.—In the thin texture of the polypidom generally, and in the form of its cells, this species resembles Sert. rosacea; but its robust habit, and the manner of its branching, give it at least equal claims to affinity with the following.

When highly magnified, the walls of the cells appear sometimes to be regularly scored with fine transverse lines; and on others there is occasionally an irregular vascular network. These markings are not constant, and the latter is probably produced by the inosculations of some minute parasite.

13. S. abietina, *cells nearly opposite or subalternate, ovato-tubular, the mouth entire; vesicles oval.*

Plate XIII. Fig. 1, 1.

Abies marina, *Ger.* emac. 1574, fig. *Sibbald* Scot. ill. lib. quart. 55. *Merr.* Pin. 1. Corallina marina abietis forma, *Raii* Syn. 35, no. 12. *Bast.* Opusc. Subs. 41. tab. 2, fig. 6; and tab. 7, fig. 1—3, pessimæ.—Muscus marinus major argutè denticulatis, *Plunk.* Phytog. tab. 48. fig. 5. *Raii* Hist. i. 78.—Muscus maritimus filicis folio, *Morris.* Plant. Hist. iii. 650, tab. 9, fig. 1.—Sea-fir, *Ellis* Corall. 4, no. 2, pl. 1, fig. *b.* B.—Sertularia abietina, *Lin.* Syst. 1307. *Pall.* Elench. 133. *Mull.* Zool. Dan. prod. 255. *Ellis* and *Soland.* Zooph. 36. *Esper* Pflanz. Sert. tab. 1, fig. 1, 2. *Lam.* Anim. s. Vert. ii. 116: 2de edit. ii. 141. *Risso*, L'Europ. mérid. v. 311. *Lamour.* Cor. Flex. 189. *Johnston* in Trans. Newc. Soc. ii. 256. *Templeton* in Mag. Nat. Hist. ix. 468. *Hassall* in Ann. and Mag. Nat. Hist. vi. 168. *Couch* Zooph. Cornw. 9: Corn. Faun. 22.—Dynamena abietina, *Flem.* Brit. Anim. 543.—La Sertularie sapinette, *Blainv.* Actinolog. 480, pl. 83, fig. 6.

Hab.—On shells and stones in deep water, common.

"This elegant coralline is frequently found on our coast, adhering by its vermicular tubes to most kinds of shells: it grows very erect, and is frequently infested with little minute shells called Serpulas." *Ellis.*—Polypidom from four to twelve inches high, of a yellowish horn colour, smooth and varnished, stout, regularly pinnate, the

stem flattened, slightly zigzag; the branches rather close, linear, alternate, bifarious, simple, or sometimes pinnated: Cells generally semialternate, rather small, bellied at the base with a narrow everted neck and plain aperture, so as somewhat to resemble a Florence-flask: Vesicles scattered, subsessile, proportionably small, smooth, ovate, with an even shortly tubulous mouth: they are produced principally in the winter season, when they are sometimes "in such abundance as almost to cover the denticles, but placed in a very regular order," *Ellis;* and always on the upper edge of the branch from which they originate.

14. S. FILICULA, *cells of the form of a Florence-flask, opposite, a single one in the axilla of each pinna; vesicles pear-shaped, smooth, the aperture shortly tubulous, entire.* Hudson.*

PLATE XIV. Fig. 1, 1.

Sertularia filicula or Fern Coralline, *Ellis* and *Soland.* Zooph. 57, pl. 6, fig. *c. C. Turt.* Brit. Faun. 215. *Rees'* Cyclop. Vermes, pl. 8, fig. 1. *Jameson* in Wern. Mem. i. 564. *Lam.* Anim. s. Vert. ii. 119. *Lamour.* Cor. Flex. 188. *Johnston* in Trans. Newc. Soc. ii. 257. *Thompson* in Ann. Nat. Hist. v. 250. *Hassall* in Ann. and Mag. Nat. Hist. vii. 284. *Couch* Cornw. Zooph. 9; Corn. Faun. iii. 23. —S. abietina, β, *Pall.* Elench. 134.—Dynamena filicula, *Flem.* Brit. Anim. 544.

Hab.—Parasitical on sea-weeds, particularly on the entangled roots of Laminaria digitata. From the observations of Mr. W. Thompson, it seems to be partial to bivalve shells on the coast of Ireland; and it is also met with on Flustræ. It is not an abundant species, but is generally distributed.

Polypidom arising from a creeping fibre, one to four inches in height, spreading bifariously, irregularly branched, slender and flexible, of a straw-yellow or brownish colour, homologous throughout; the rachis zigzag, or "bent to and fro into alternate angles," closely pinnated, the pinnæ shooting from every bend alternately on opposite sides, linear, patent, simple or composite: Cells closely set, minute, giving a serrulated appearance to the ramifications of the polypidom, shaped something like a Florence-flask, smooth, the aperture oblique, entire: The vesicles are rarely produced, nor have

* William Hudson, a London apothecary, elected F.R.S. in 1761: the author of the "Flora Anglica," the publication of which, in 1762, "marks the establishment of Linnæan principles of Botany in England, and their application to practical use."—*Sir. J. E. Smith.*

I seen a specimen with them : they are represented by Ellis as of a pear shape, with a short tubulous aperture.

This, like its ally the S. abietina, is often infested with Serpulæ ; but it is a much more delicate species, and, notwithstanding the similarity of their specific characters, perfectly distinct. "The singularity of its waved stem, with its erect single denticle at the insertion of the branches, together with the single pair of denticles on each part of the stem, that form the angles, make it a very distinct species from any of this genus." *Ellis.*

15. S. OPERCULATA, *cells opposite, inversely conical, the aperture patulous, obliquely truncate, pointed on the outer edge, with two small lateral teeth ; vesicles obovate.* Mr. Newton.

PLATE XIV. FIG. 2, 2.

Muscus marinus denticulatus, procumbens, caule tenuissimo, denticulis bijugis, *Raii* Hist. i. 79. *Morrison* Plant. Hist. Oxon. iii. 650, tab. 9, fig. 3. *Plukenet* Phytogr. tab. 47, fig. 11.—Corallina muscosa, denticulata procumbens, *Raii* Syn. 36, No. 18.—Sea-hair, *Ellis* Corall. 8, No. 6. tab. 3, fig. *b. B.*—Sertularia operculata, *Lin.* Syst. 1307. *Ellis* and *Soland.* Zooph. 39. *Berk.* Syn. i. 216. *Esper* Pflanz. Sert. tab. 4, fig. 1, 2. *Lam.* Anim. s. Vert. ii. 118. *Johnston* in Trans. Newc. Soc. ii. 258, pl. 11, fig. 2. *Templeton* ut supra cit. 468. *Hassall* in Ann. Nat. Hist. vi. 168. *Couch* Zooph. Cornw. 9. *Macgillivray* in Ann. and Mag. Nat. Hist. ix. 464. *Couch* Corn. Faun. iii. 23.—S. usneoides, *Pall.* Elench. 132. —Dynamena operculata, *Lamour.* Cor. Flex. 176. *Flem.* Brit. Anim. 544. *Blainv.* Actinolog. 483, pl. 83, fig. 5. *Krauss* Corall. and Zoophyt. der Sudsee, 27.—Dynamena pulchella, *D'Orbigny.*

Hab.—Near low-water mark on Fuci, particularly on the stalks of Laminaria digitata. Common on all parts of the British coast.

Grows in tufts from two to four, or even twelve inches high. The shoots are slender and neat, filiform, flexuose or widely zig-zag, always erect, alternately branched, the branches erect, and, like the first shoot, serrulated with the polype-cells, which are exactly opposite, and less everted than is usual to the genus. The outer angle of the aperture of the cell is produced into an acute point, and there is a sharp tooth on each side, which is omitted in the otherwise admirable figure of Ellis, although it could not escape his lyncean eye.* Often there is only a tooth on one side of the margin of the aperture, and this is sometimes so far advanced that the apex may be said to be bicuspidate. The latter formation is particularly

* "Zoophytorum lynceus Ellisius." *Lin.* Syst. 1071.

observable in some specimens from the coast of Africa. Mr. Macgillivray has made the same observation :—"Sometimes the cells have one of the lateral teeth abortive or wanting; in the latter case the remaining tooth is often as long as the mucronated tip, which thus appears bifid. On a small specimen before me, presenting the above arrangement, a solitary, somewhat obovate, compressed, truncated, and operculated vesicle has its lateral margin so sinuated as to present three distinct notches." The vesicles are irregularly scattered on the branches, large, smooth, egg-shaped, the top often covered with a sort of rounded operculum. They are produced abundantly in the winter season and in spring, when indeed, I think, the ovaries appear on the greater number of this order of corallines. It was from the great resemblance of these vesicular ovaries to the capsules of mosses, that the early botanists drew an additional argument in behalf of the vegetability of the corallines themselves;* and a Darwinian might be, perhaps, forgiven, were he even now to feign how the Nereides stole them from the mossy herbelets of Flora's winter and vernal shows, to deck and gem the arbuscular garnitures of their own coral caves!†

The shoots are usually so little waved, that Pallas' term "subflexuosi" is very appropriate; but in the collection of Dr. Coldstream there is a large specimen, from the Frith of Forth, in which they are remarkably zigzag or kneed, so as to give it a peculiar character and appearance. In the same collection are specimens from the

* "These vesicles appearing at a certain season of the year, according to the different species of corallines, and then falling off, like the blossoms or seeds of plants, has made some curious persons, who have not had an opportunity of seeing the animals alive in the vesicles, conclude them to be the seed-vessels of plants; and into this mistake I was led myself, in the account laid before the Royal Society in 1752: in which account I had taken some pains to point out the great similitude between the vesicles and denticulated appearance of some of these corallines, and the tooth-shaped leaves and seed-vessels of some species of land-mosses, particularly of the Hypnum and Bryum."—*Ellis*, Corall. Introd. ix.

† "Nymphs! you adorn, in glossy volutes roll'd,
The gaudy conch with azure, green, and gold.
* * * * *
You chase the warrior shark, and cumbrous whale,
And guard the mermaid in her briny vale;
Feed the live petals of her insect-flowers,
Her shell-wrack gardens, and her sea-fan bowers;
With ores and gems adorn her coral cell,
And drop a pearl in every gaping shell."

Botanic Garden, Canto iii.

Cape of Good Hope, which differ in no respect from those of our shores.

"I have collected a few examples of a black, as well as many of a red colour." *W. Thompson.*

16. S. ARGENTEA, *polypidom cauliferous ; cells nearly opposite or subalternate, urceolate, acutely pointed, the upper half divaricated ; vesicles oval.* Merret.

PLATE XV. and PLATE XIV. FIG. 3, 3.

Corallina comis ad instar caudæ vulpinæ sparsis.—Sheep's tailed Coralline, *Merr.* Pin. 29.—Corallina muscosa, alterna vice denticulata, ramulis in creberrima capillamenta sparsis, *Raii* Syn. i. 36, No. 17.—Muscus marinus denticulatus minor ramulis in creberrima capillamenta sparsis, *Pluknet* Phytog. tab. 48, fig. 3.—Muscus marinus minor denticulis alternis, *Morris.* Hist. Plant. Oxon. iii. 650, tab. 9, fig. 4.—Squirrel's-tail, *Ellis* Corall. 6, No. 4, pl. 2, fig. *c*, *C.*—Sertularia cupressina, *β*, *Lin.* Syst. 1308.—S. cupressina, *Esper* Pflanz. Sert. tab. 3, fig. 1, 2.—S. argentea, *Ellis* and *Soland.* Zooph. 38. *Berk.* Syn. i. 216. *Esper* Pflanz. Sert. tab. 27, fig. 1, 2. *Lam.* Anim. s. Vert. ii. 117. *Lamour.* Cor. Flex. 192. *Johnston* in Trans. Newc. Soc. ii. 258, pl. xi. fig. 4.—*Hassall* in Ann. and Mag. Nat. Hist. vi. 168. *Couch* Zooph. Cornw. 10: Corn. Faun. iii. 25.—Dynamena argentea, *Flem.* Brit. Anim. 544.

Hab.—In deep water. On oysters and other large bivalved shells, as also on the stalk of Laminaria digitata, common, and frequently met with in closely aggregated clusters. "Grows occasionally in brackish water, and in shallow pools. I have found it, in some quantity, attached to dead mussels, in a shallow pool in Dundrum Bay, co. Down, into which a river flows. A mass of it was once brought to me from one of the flood-gates of a dock in Belfast, to which it was found attached."—*W. Thompson.*

Polypidom from six to eighteen inches high, cauliferous, the stem percurrent, filiform, waved or straight, smooth, of a dark-brown colour, divided at rather wide but regular intervals by an oblique joint, clothed with short panicled dichotomous branches which spread out on every side, and being all of the same size or nearly so (excepting at the bottom where they are less branched and smaller, and at the top where they also frequently become gradually shortened), the whole coralline assumes somewhat of the shape of a squirrel's tail, and has given origin to its English name. Two branches usually arise from each internode of the stem, and they come off in such a manner that four or five of them complete a whorl. The polype-cells on the stem are alternate, appressed, and appear to be less than those on the branches, which are placed in two rows with

their orifices inclined to one side; they are bellied like a Florence-flask, with a narrow divaricated neck terminated with a small oblique aperture: on some of the branchlets every pair is separated by a joint or stricture, while on others several pairs occur in succession without the interference of such a stricture. Vesicles scattered, oval, smooth, attenuated at the base.

In young specimens of an inch or two in height the polypidom is simply pinnate, and as it rises, the branches gradually divide into more numerous segments. In Plate XIV. Fig. 3, I have given a figure of such a specimen, selected from many others, on account of its greater divergence from the usual character of the species. When, on the contrary, the polypidom attains a foot or more in height, the lower half of the stem loses its branches and cells, and becomes entirely naked. I think it likely that such a specimen, of the unusual size of three feet, constitutes the *Sertularia uber* of *Sir J. G. Dalyell*, in Edin. New Phil. Journ, xvii. 412.

"Independently of the differences to be observed in the form of the cells and vesicles, which are generally pretty constant, between this and the following species (*S. cupressina*) there are many others pertaining to their general habit and appearances. The polypidoms of this species are frequently met with growing in closely aggregated clusters, and are sometimes even branched—a condition in which I have never found the other: it is also of a darker colour, and more rigid texture, and never attains the same height. The polypiers also do not end in the beautiful spire so remarkable in *S. cupressina*, but terminate much more abruptly. The branches too are usually shorter, broader, and *not arched*, as in the other species." *A. H. Hassall.*

17. S. CUPRESSINA, *polypidom cauliferous; cells nearly opposite, tubulous, adnate, the aperture scarcely contracted, bilabiate, with two minute spinous teeth; vesicles nearly oval.* Ellis.

PLATE XVI.

Sea-cypress, *Ellis* Corall. 7, No. 5, pl. 3, fig. *a*, *A*.—Sertularia cupressina, *Lin.* Syst. 1308. *Ellis* and *Soland.* Zooph. 38. *Berk.* Syn. i. 216. Wern. Mem. i. 564. *Lam.* Anim. s. Vert. ii. 118. *Lamour.* Cor. Flex. 192. *Hogg's* Stock, 32. *Templeton* in loc. cit. 468. *Stark* Elem. ii. 440, pl. 8, fig. 12. *Risso* L'Europ. mérid. v. 311. *Hassall* in Ann. and Mag. Nat. Hist. vi. 168. *Macgillivray* in ibid. ix. 464. *Couch* Zooph. Cornw. 11: Corn. Faun. iii. 26.—Dynamena cupressina, *Flem.* Brit. Anim. 543.

Hab. "The Sea-cypress is chiefly found in deep water on the coast of Yorkshire, Scotland, and the north of Ireland," *Ellis.* St. Ives' Bay, Cornwall, *Couch.* Scarborough, *Mr. Bean.* Frith of Forth, *Jameson.* Cork Bay, *Mr. J. V. Thompson.* On the shore of Magilligan Strand, co. Derry, *Templeton.* Dublin Bay, abundant, *A. H. Hassall.* Very rare on the east coast of Cornwall, owing no doubt to the want of muscles and oysters; more common on the north coast; plentiful in Devon and Norfolk, *C. W. Peach.*

This is in general a larger and stouter species than the preceding, with longer branches more decidedly fan-shaped, the pinnæ being closer and more parallel to one another. The cells are in two rows, nearly opposite, smooth, and pellucid, adnate, with the margin of the comparatively wide aperture sinuated so as to form two or sometimes three prominent denticles. The branches, in some specimens, are gracefully arched, bending as it were under the load of pregnant ovaries which they carry, and which are arranged in close-set rows along the upper side of the pinnæ. They are of an oval shape, smooth, attenuated at the base, with sometimes a sharp spine at each corner of the apex; but these are oftener absent.

This and the preceding have a distinct stem, in which they differ from all the other native species, which are pre-eminently frondose or homologous, the offsets and pinnæ being in all respects the same as the primary shoot. Pallas maintains that they constitute but one species, his *S. cupressina*, Elench. 141—the characters assigned to them respectively being far from specifical, since he found, on one and the same specimen, that the young vesicles had long spines at their tops, the more mature shorter ones, and on full-grown vesicles they were nearly or altogether obsolete; while bluntly tubulous and acutely pointed cells occurred promiscuously, on the same stalk, in specimens of every size and exterior habit. Linnæus, apparently swayed by these assertions, followed Pallas; but Ellis, in a later work, adhered to his first opinion, for, "besides the difference of their denticles (cells) and ovaries," which he evidently regarded as permanent, they have, he says, "quite a different habit and manner of growing." All subsequent writers have assented to Ellis's views, most of them, at the same time, expressing a suspicion of their correctness; and my own limited observations have possessed me with the same dubiety. Specimens can be readily produced which, from habit and the figure of their cells, will be at once pronounced the representatives of distinct species, but a wider examination may lead to another conclusion. I have seen no specimens of S. cupres-

sina with the *cells* of S. argentea,* but I have seen several which, from their habit, I would refer to the latter, with the *cells* and *vesicles* of the former. Such a specimen is figured in Plate xiv. Fig. 4. I can also state that, on the same specimen, I have observed cells that might be considered as belonging to either species; and with these facts I should, perhaps, have amalgamated the synonymes, had I not been aware that some of our best naturalists—for example, Bean and J. V. Thompson—are opposed to the junction. "Besides," to adopt the words of Professor Lindley in a somewhat similar discussion, "our daily experience shows us that excessive analysis is far preferable to excessive synthesis, especially for the purposes of students: the former leads to no other inconvenience than that of increasing the degree of investigation which *species* must receive to be understood; the latter has a constant tendency to render investigation superficial, and characters confused." Syn. of the British Flora, Pref. p. ix.

Professor Jameson has inserted SERTULARIA CUPRESSOIDES among those species found in the Frith of Forth, Wern. Mem. i. 564; and in the work entitled "Corallina," p. 83, the elegant Australasian S. ELONGATA and S. PECTINATA are said to be found on the English coast. I believe there is some error in all these instances.

Fig. 14.

I have repeatedly observed on oyster-shells, and among the roots of corallines, a sessile vesicular body filled with milk-white granules, resembling very exactly the oviferous vesicle of a Sertularia. It is rooted, subsessile, roundish, slightly flattened on the sides, smooth, with a short tubulous even aperture. Fig. 14. It has no attachment to any organised body, and is the nidus of some minute Fusus or Purpura. Mr. Peach has found embryo shells in it.

* It deserves to be remarked, in connection with this point, that the characters of S. argentea given by Lamarck are really those of S. cupressina; and this has ascribed to it the diagnostics of S. argentea.—"I cannot perceive any permanent character by which S. cupressina can at all times be distinguished from S. argentea, although typical specimens of each form bearing these names appear considerably different from each other. Both are found around the Irish coast, and, together with many other zoophytes, constituted the most beautiful collection of these objects I ever beheld, when gracefully depending from, and interlacing the spacious trawl-nets of the Howth fishermen, as they were hung up to dry on the decks of the fishing-smacks. Of the numerous species then, in April 1835, obtained, S. argentea and S. cupressina were the most attractive, from their graceful form and magnitude, some examples attaining to nearly two feet in height." *W. Thompson.*

7. Thuiaria,* Fleming.

Character.—*Polypidom plant-like, rooted by a tubular fibre, erect, dichotomously branched or pinnated; the cells sessile, biserial, adnate to the rachis or "imbedded in the substance of the stem and branches;" vesicles scattered.—Polypes hydraform.*

1. Th. thuia, *cells ovato-elliptical, rather acute; vesicles pear-shaped.* Sir Robert Sibbald.†

Plates XVII. and XVIII., Fig. 1, 2.

Planta marina equiseti facie, *Sib.* Scot. Ill. ii. lib. iv. 55, tab. 12, fig. 1.—Fucus equiseti facie, Ibid. lib. i. 56. *Raii* Syn. 50, no. 47.—Bottle-brush Coralline, *Ellis* Corall. 10, no. 9, pl. 5, fig. *b, B.*—Sertularia thuja, *Lin.* Syst. 1308. *Pall.* Elench. 140. *Ellis* and *Soland.* Zooph. 41. *Berk.* Syn. i. 217. *Esper* Pflanz. Sert. tab. 22, fig. 1-3. *Turt.* Gmel. iv. 678. Wern. Mem. i. 564. *Turt.* Brit. Faun. 213. *Stew.* Elem. ii. 442. *Lamour.* Cor. Flex. 193. *Hogg's* Stock. 32. —Cellaria thuia, *Lam.* Anim. s. Vert. ii. 339. *Stark* Elem. ii. 439.—Thuiaria thuia, *Flem.* Brit. Anim. 545. *Johnston* in Trans. Newc. Soc. ii. 261. *Couch* Zooph. Corn. 11: Corn. Faun. iii. 27, pl. 5. *Macgillivray* in Ann. and Mag. Nat. Hist. ix. 464. *W. Thompson* in Ibid. xiii. 440.—Biseriaria thuia, *Blainv.* Actinol. 482, pl. 81, fig. 3.

Hab. On shells from deep water. "They are found on the coast of Scotland, and in the north of England, particularly about Scarborough, where the fishermen have given them the name of Bottle-brushes," *Ellis.* "Very frequently found on the coast of Durham," *J. Hogg.* Common on N. Durham and Berwickshire, *G. J.* Leith shore, *Jameson.* Near Dundee, *W. Jackson, jun.* Coast of Cornwall, very rare, *R. Q. Couch.* Northern coast of Ireland, *W. Thompson.*

* Formed from θυΐα, a cedar. There is a *Thuarea* in Botany, so near to the zoophytical genus in sound as to render this name objectionable. The Thuarea is formed from the name of the botanist A. du Petit-Thouars.

† There is a very interesting life of Sir Robert, written by himself, in the Analecta Scotica, v. i. p. 126 et seq. It is printed in a separate form, with the title "The Autobiography of Sir Robert Sibbald, Knt., M.D.; to which is prefixed a short account of his MSS.," 8vo.; published by Thomas Stevenson, Edin. 1833. The pamphlet forms the basis of his Life prefixed to the 20th vol. of the "Naturalist's Library," with which a portrait is also given. Sir Robert was born 15th April 1641; graduated in 1662; was knighted in 1682; and died, probably, in 1722, for the precise date has not been ascertained.—See Pulteney's Sketches of the Progress of Botany, v. ii. p. 4-8.—The following Elogium is from the Second Series of the Analecta Scotica, p. 153, Edin. 1837:—

> "Illustrata simul decorat, pariterque Sibaldum
> Scotia, scriptori lumine grata suo."

This remarkable coralline is sometimes a foot in height, generally less, affixed by a tubular fibre, which is sometimes agglutinated to others from other shoots, so as to form a lichen-like crust concentrically wrinkled. Stem percurrent, erect, filiform, rigid, zig-zag, knotted, naked underneath, bearing on the upper part a cylindrical tuft of dichotomous short equal branches, coming off alternately and so disposed that four complete a whorl. The knots on the lower part are the remains of former branches, which seem to drop off as the portion of the stem immediately beneath them successively loses its vitality. The stem has no cells, and neither it nor the branches are jointed. Cells close-pressed, arranged in two rows, sub-alternate, smooth, tapered from the base to a contracted orifice. Vesicles subpedicellate, pear-shaped, smooth, placed in clusters or solitary on the upper side and towards the base of the branches. They are produced mostly in the winter season, and are filled with a milk-white grumous fluid previous to the discharge of the ova.

Young specimens of this polypidom are simply pinnate, but these may be always distinguished from the following species by the greater intervals between the origin of the pinnæ, and by the shape of the cells. The Figures 1, 2 of Plate XVIII. represent a specimen of this kind; which have been the more readily introduced, since they exhibit the living polypes in an active state, and prove that the coralline has no relationship to Cellaria..

The Sertularia thuia of *Fabricius,* in his Fauna Groenlandica, p. 444, I am inclined to refer to Sertularia pumila.

2. Th. articulata, *cells ovate, obtuse or truncate; ovarian vesicles elliptical.* Ellis.

Plate XVIII. Fig. 3, 4.

Sea-spleenwort or Polypody, *Ellis* Corall. 11, no. 10, pl. 6, fig, *a*, *A*.—Sertularia articulata, *Pall.* Elench. 137. *Esper* Pflanz. Sert. tab. 8, fig. 1, 2.—S. Lonchitis, *Ellis* and *Soland.* Zooph. 42.—S. Lichenastrum, *Berk.* Syn. i. 219. *Turt.* Brit. Faun. 216. *Stew.* Elem. ii. 447.—Cellaria Lonchitis, *Lam.* Anim. s. Vert. ii. 139: 2de édit. ii. 186.—Thuiaria articulata, *Flem.* Brit. Anim. 545. *Hassall* in Ann. Nat. Hist. vii. 284, pl. vii. fig. 1, 2. *Couch* Zooph. Cornw. 12: Corn. Faun. iii. 28, pl. 4.

Hab. On shells and stones in deep water, rare. In the harbour of Dublin, *Ellis.* "I have remarked this species adherent to the Pecten maximus dredged at Donaghadee, co. Down; and Mr. E. Forbes finds it on Pecten opercularis at the Isle of Man. Mr.

Hyndman, when dredging on two occasions near Sana Island (Scotland), brought it up from about 40 fathoms' water, in some quantity and remarkably fine. Some of the specimens are greatly branched, spreading out to six inches, and one example has attained the height of ten inches and a half. The pinnæ are alternate in all the specimens from the above stations." *W. Thompson.* Common on the shores near Liverpool, *H. Johnson.* Whiteburn, Northumberland, *Miss M. Dale.* Scarborough, *W. Bean.* Rare in Cornwall ; fine in Devon ; and not common in Norfolk, *Charles W. Peach.*

Polypidom about four inches high, simple or irregularly divided ; of a pale horn colour and texture, the lower part of the rachis filiform and wrinkled like that of Tubularia larynx, compressed upwards and finely wrinkled when dry, divided by joints not regularly equidistant, often naked on the lower half, pinnated above and celliferous ; pinnæ simple, usually about an inch in length, patent, rather close-set, not exactly opposite nor yet properly alternate, originating in a narrow base. Cells in a single series along each side, semi-alternate, ovato-tubular, short, with a round plain aperture. Vesicles issuing from both sides of the pinnæ, most numerously from the upper, subpedicellate, elliptical, smooth, the orifice contracted and even.

The synonymes of this species are somewhat confused. Pallas affirms, correctly in my opinion, that the Sea-spleenwort of Ellis is not the Sertularia Lichenastrum of Linnæus, as is generally asserted ; and he has described a different species, considered by him as identical with the Linnæan. This is the species represented by Esper, Pflanz. Sert. tab. 35, fig. 1-3. The figure of Ellis is quoted by Pallas as an admirable representation of his own S. articulata ; but in the description of this the branches or pinnæ are said to be opposite, whereas in Ellis's figure, and in our own, although less decidedly, they are regularly alternate. Ellis notices under his S. Lonchitis a foreign variety with opposite cells and pinnæ, having "the joints both on the stem and branches much closer together ;" and it will probably be found that this constitutes a distinct species, hitherto confounded with others nearly allied.

8. Antennularia,* Lamarck.

Character. — *Polypidom plant-like, horny, simple or branched irregularly, the shoots fistular, jointed, clothed with*

* From *Antennula*, the diminutive of *antenna*, a term applied to the feelers of insects.

hair-like verticillate branchlets; cells small, sessile, campanulate, unilateral; vesicles scattered, unilateral. — *Polypes hydraform.*

1. An. antennina, *polypidoms clustered, simple, elongated; branchlets short; polype-cells with intermediate cellules.* Mrs. Ward.*

Plate XIX. Fig. 1, 3.

Corallina astaci corniculorum æmula, *Raii* Syn. i. 34, no. 10.—Corallina affinis, non ramosa, *Pluken.* Almag. Bot. 119.—Muscus marinus s. coralloid. non ramosus, erectus, *Pluken.* Phytog. tab. 48, fig. 6.—Lobster's-horn coralline or Sea-beard, *Ellis* Corall. 15, no. 14, pl. 9, fig. *a*, A. B. Phil. Trans. xlviii. 630, tab. 22, no. 3. Phil. Trans. abridg. x. 491, pl. 12, fig. 3, C.—Sertularia antennina, *Lin.* Syst. 1310. *Pall.* Elench. 146. *Ellis* and *Soland.* Zooph. 45. *Oliv.* Zool. Adriat. 289. *Berk.* Syn. i. 217. *Esper* Pflanz. Sert. tab. 23, fig. 1-4. *D. Chiaie* Anim. s. Vert. Nap. iv. 144. *Hogg's* Stock. 33.—Nemertesia antennina, *Lamour.* Cor. Flex. 163.—Antennularia antennina, *Flem.* Brit. Anim. 546. *Johnston* in Trans. Newc. Soc. ii. 260. *Hassall* in Ann. and Mag. Nat. Hist. vi. 168, pl. 5, fig. 3. *Macgillivray* in Ibid. ix. 464. *Couch* Zooph. Corn. 13: Corn. Faun. iii. 29, pl. 7. —Ant. indivisa, *Lam.* Anim. s. Vert. ii. 123: 2de édit. ii. 156. *Templeton* in Mag. Nat. Hist. ix. 468. *Blainv.* Actinolog. 486, pl. 83, fig. 3.

Hab. "Grows in clusters on sandy soils or on stones lying in sand, rooted together by small brown tubular fibres, which are matted together by sand and fragments of shells." *R. Q. Couch.* Generally distributed on the British shores.

Polypidoms clustered, rooted by a sponge-like mass composed of numerous implexed tubular fibres, erect and straight, attaining a height of eight inches and upwards, cylindrical, regularly jointed, of a clear yellowish horn colour, usually undivided, but sometimes irregularly branched. In these instances the branches are exactly like the primary shoot, and are equally beset with hair-like branchlets, arranged in numerous whorls—a whorl to each articulation. "The number of branchlets in each whorl varies from five to nine, and in the same specimen the number usually remains the same throughout." *Hassall.* When magnified, they "have the appearance of sickles, and bend in towards the main stem:" they are capillary, swollen at the base, irregularly jointed, the joints oblique, thickened; the cells small and campanulate with an even rim, distant, with two or three abortive cells or denticles between each. Vesicles egg-shaped, situated in the axils of the whorls, subpedicellate,

* "Found on the rocks by Mrs. Ward, an ingenious gentlewoman of Gisburgh, in Cleveland, Yorkshire, and by her named *Sea-beard*; I suppose from its growing in a thick tuft. Mr. Lawson."—*Ray.*

smooth, with a subterminal circular aperture "looking towards the middle stem."

"This species sometimes takes a creeping habit, throwing out branches at various points from a horizontal stem, which, in all points, resembles the stems in the typical state. The branches thus thrown out are about three inches high." *T. G. Rylands.*

In specimens cast on shore after storms, the branchlets are almost always broken short, when the polypidom assumes, in a more marked manner, the appearance of the Lobster's horn or antenna,—whence the name of the genus and species.

This very fine zoophyte is agreeably associated in my mind with recollections of my friend Charles William Peach. The following little narrative will explain the link that binds them together; and the episode that adds another name to the useful list of those who have pursued, successfully, science under many difficulties and discouragements will surely be excused: "I was born at Wansford, in the county of Northampton, on the 30th September 1800. At this time my father was a saddler and harness-maker; and, as he was of an enterprising turn, he took a small inn in the village when I was very young, and afterwards about eighty acres of land, and gave up his other business. Being of a studious turn, and fond of books, I was kept at school until fifteen years of age; and from that time until twenty-three years of age, I was employed in assisting in the inn and upon the farm, and frequently scolded for attending to books instead of the plough. I was then appointed as a riding officer in the coast-guard at Weybourn, in the port of Clay, Norfolk. At that time I knew nothing of natural history. From having all my life been confined inland, and not having seen the sea, I was much struck with all connected with it; and I well remember how delighted I was with a most splendid specimen of *Antennularia antennina*, which was placed upon the chimney-piece of the little parlour of the inn I stopped at when I joined my station: it excited a curiosity which was not satisfied until I found out what it was, and I believe I may date my progress from that time. I continued to collect for the *beauty* of the forms and colours of the agates until 1825, when I met the Rev. J. Layton, then at Catfield, who, finding I collected, asked 'whether I should not like to know the names, &c. of what I collected?' Of course, I wished to know. He invited me to his house. From that time to the present I have endeavoured to gain all the information I could. I never wrote a paper, or read one, (in fact, I never heard but one scientific lecture,)

until the meeting of the British Association at Plymouth, in 1841, when I read one on the Organic Fossils of Cornwall. It is impossible to describe the feeling I rose under;—that is over long since; and the only beating of my heart about the British Association *now* is, that of gratitude towards its members, and of love for their great kindness. I feel the love of and for scientific pursuits strengthen every day; and I feel that I have taken hold of that which affords *every day* a 'feast of reason and flow of soul.'"

2. AN. RAMOSA, *polypidom branched, branchlets of the whorls longer; polype-cells without intermediate cellules.* D. Dare.

PLATE XX.

Corallina ramosa cirris obsita, *Raii* Syn. 35, no. 11. *Ellis* Corall. 16, pl. 9, *b* and *c*. —Sertularia antennina, *β*, *Lin.* Syst. 1310.—Nemertesia ramosa, *Lamour.* Cor. Flex. 164.—Antennularia ramosa, *Lam.* Anim. s. Vert. ii. 123: 2de édit. ii. 156. *Stark* Elem. ii. 440. *Templeton* in lib. cit. 468. *Hassall* in Ann. and Mag. Nat. Hist. vi. 168, pl. 5, fig. 1, 2.—Sertularia seticornis, *Hogg's* Stock. 33.—Antennularia arborescens, *Hassall* in Ann. Nat. Hist. xi. 111.—A. antennina, var. *Johns.* Brit. Zooph. 140, pl. 16, fig. 2. *Couch* Corn. Faun. 29.

Hab. On old shells and stones from deep water. "In littore Dubrensi collegit *D. Dare* Pharmacopæus Londinensis," *Ray*. It is as common as the preceding, and is found on all our coasts.

"This differs," says Ellis, from the preceding, "in being branched out, and in having its capillary ramifications much longer." Nevertheless, Ellis deemed them "one species;" and to this conclusion he was unhesitatingly followed by Pallas and by Dr. Fleming. Lamarck and Lamouroux fell back upon the older opinion of Ray; but they had not discovered any new diagnostic to support the distinctions they defined, which seem to have been made merely in the indulgence of an analytical spirit. Hence I followed the view of Ellis in the first edition of this work—a view still considered as correct by Mr. Couch. "There are," he says, "two variations of this species which at first would seem to constitute specific differences, but after many examinations I am inclined to think they are only varieties." I confess myself to remain of Mr. Couch's opinion.

From a closer examination, Mr. Hassall was the first to say, on apparently better grounds, that these varieties might be really species. He tells us that Ant. ramosa arises "by a single trunk, which subsequently divides and subdivides into numerous branches;"

the branchlets are long; and the cells are "not separated from each other by one or more small cup-like processes, as are those of Antennularia antennina." The value of these characters has been confirmed by the experience of Mr. John M'Gillivray. "My specimens agree with Mr. Hassall's one in arising from a *single* trunk which divides into numerous branches, which again subdivide; nor in them have I been able to detect any of 'the small tubular cells placed between the larger ones,' which are never absent upon the unbranched polypidom. The absence of these cells, together with the peculiar *habit*, seem to justify Mr. Hassall in considering *his* A. ramosa as a good species. At the same time it would appear that there is *another* (slightly) branched state of A. *antennina*, which is unquestionably a mere accidental variation, being provided with 'the small tubular cells' above alluded to, as I have ascertained by the examination of several specimens." Mrs. Griffiths, an authority always quoted with fond respect, writes to the same purport—"Were this and Ant. antennina not distinct, I think we should sometimes see them run a little into each other, which, I believe, is never the case, and the pinnæ of the former are much longer."

I have examined numerous specimens, some of them very much branched, but I have never found one without the intermediate cellules.

9. Plumularia,* Lamarck.

Character.—*Polypidom plant-like, rooted, simple or branched, the shoots and offsets plumous; cells small, sessile,*

* Formed from *Plumula*, the dimin. of Pluma, a feather.—I have, in common with most French authors, adopted the generic names of Lamarck, in preference to those of Lamouroux, although aware that the claim of priority is generally allowed to the latter; but let us hear what Milne-Edwards says:—"Pendant que Lamarck préparait le grand ouvrage dont le second volume est consacré aux Polypes, Lamouroux s'occupait du même sujet, et fit paraître à Caen un traité spécial sur les Polypiers coralligènes flexibles. D'après la date de la présentation de son manuscrit à l'Institut, on pourrait même lui attribuer l'antériorité sur Lamarck, et penser que ce dernier savant, nommé par l'Académie des Sciences commissaire pour l'examen du mémoire de Lamouroux, avait profité de cette circonstance pour s'approprier les résultats obtenus par ce zoologiste. Un auteur récent semble porté à croire que les choses se sont passées de la sorte; mais les traditions du muséum prouvent qu'il n'en est rien, et je me plais à rendre ici toute justice à la conduite de Lamarck. En effet, M. Valenciennes, qui était alors attaché à Lamarck en qualité d'aide-naturaliste, m'a assuré que depuis long-temps toutes les divisions génériques établies par ce professeur dans la classe des Polypiers se trouvaient indiquées dans la collection publique du muséum, et que pour faciliter le travail de Lamouroux sur le même sujet,

unilateral, usually seated in the axilla of a horny spine; vesicles scattered, unilateral.—Polypes hydraform.

* Stem a single tube.

1. P. FALCATA, *stem waved, branched; branches alternately pennated; cells close-ranked, shortly tubulous with a plain rim; vesicles oblong-oval,* Merrett.*

PLATE XXI. Fig. 1, 2.

Muscus marinus spiralis pennatus, *Merr.* Pin. 81.—Corallina muscosa pennata, ramulis et capillamentis falcatis, *Raii* Syn. i. 36, no. 16. — Muscus pennatus, ramulis et capillamentis falcatis, *Pluken.* Phytog. tab. 47, fig. 12.—Muscus maritimus pennatus, ramulis et capillamentis falcatis, *Morris.* Plant. hist. Ox. iii. 650, tab. 9, fig. 2.—Sickle Coralline, *Ellis* Corall. 12, no. 11, pl. 7, fig. *a*, A. and pl. 38, fig. 6.—Corallina erecta pinnata, *Bast.* Opusc. Subs. 41, pl. 2, fig. 5, malè.—Sertularia falcata, *Lin.* Syst. 1309. *Pall.* Elench. 144. *Ellis* and *Soland.* Zooph. 42. *Esper* Pflanz. Sert. tab. 2, fig. 1, 2. *Berk.* Syn. i. 217. *Blumenb.* Man. 273.—Aglaophenia falcata, *Lamour.* Cor. Flex. 174.—Plumularia falcata, *Lam.* Anim. s. Vert. ii. 125: 2de édit. ii. 160. *Grant* in Edin. New Phil. Journ. i. 155. *Flem.* Brit. Anim. 546. *Johnston* in Trans. Newc. Soc. ii. 259. *Hassall* in Ann. and Mag. N. Hist. vi. 169. *Couch* Zooph. Cornw. 14: Corn. Faun. iii. 30.

Hab. On shells and rocks near low-water mark, and in deep water.

A common and very elegant species, generally from four to six inches in height, sometimes attaining to twelve, rising in wide spiral turns, and sending out from its filiform percurrent stem, at regulated intervals, alternate spreading plumous branches which are placed one above the other on the outer side. Pinnæ alternate, bifarious. In young specimens the branches are two-ranked and alternate, and I have seen this character remain in one specimen of considerable size. There are no cells on the spiral stem, but they occur on the branches as well as on the pinnæ, and are arranged in two rows pointing alternately to opposite sides. There is

Lamarck avait mis généreusement à sa disposition toutes les richesses de cet établissement déja denominées et classées par ses soins."—Ann. des Sc. Nat. Part. Zool. tom. vi. second ser. p. 12.

* For an account of Dr. Christopher Merrett, see Wood's Athen. Oxon. v. ii. p. 930; Pulteney's Sketches, v. i. p. 290, &c.; and Thomson's Hist. of the Roy. Soc. p. 22. He was born in 1614; was one of the original members of the Royal Society; and died in 1695. Ray's character of him in 1688 is—" Annis et scientia gravis, de Professione sua deque Repub. Botanica optime meriti." Hist. Plant. præf. Contrast this with the character in Sir J. E. Smith's Eng. Flora, i. pref. vii-viii. Those who care to study Merrett's character may, perhaps, find a key to it in the " Epistola ad Lectorem" of the Pinax.

a fine figure of the coralline in the centre of the curious frontispiece to Ellis's Essay; and the magnified figure in tab. 38 is a more correct representation of the cells than that given in tab. 7, which has been drawn from a dried specimen. The ovarian vesicles are of uncertain occurrence, and I have seldom seen them: they are scattered irregularly on the branches, stalked, ovate or pear-shaped, with a short tubulous aperture, and occasionally wrinkled longitudinally when dry.

"This species is very common in the deeper parts of the Frith of Forth: its vesicles are very numerous, and its ova are in full maturity at the beginning of May. The ova are large, of a light-brown colour, semi-opaque, nearly spherical, composed of minute transparent granules, ciliated on the surface, and distinctly irritable. There are only two ova in each vesicle: so that they do not require any external capsules, like those of the Campanularia, to allow them sufficient space to come to maturity. On placing an entire vesicle, with its two ova, under the microscope, we perceive, through the transparent sides, the ciliæ vibrating on the surface of the contained ova, and the currents produced in the fluid within by their motion. When we open the vesicles with two needles, in a drop of sea-water, the ova glide to and fro through the water, at first slowly, but afterwards more quickly, and their ciliæ propel them with the same part always forward. They are highly irritable, and frequently contract their bodies so as to exhibit those singular changes of form spoken of by Cavolini. These contractions are particularly observed when they come in contact with a hair, a filament of conferva, a grain of sand, or any minute object; and they are likewise frequent and remarkable at the time when the ovum is busied in attaching its body permanently to the surface of the glass. After they have fixed, they become flat and circular, and the more opake parts of the ova assume a radiated appearance; so that they now appear, even to the naked eye, like so many minute grey-coloured stars, having the interstices between the rays filled with a colourless transparent matter, which seems to harden into horn. The grey matter swells in the centre, where the rays meet, and rises perpendicularly upwards, surrounded by the transparent horny matter, so as to form the trunk of the future zoophyte. The rays first formed are obviously the fleshy central substance of the roots; and the portion of that substance which grows perpendicularly upwards, forms the fleshy central part of the stem. As early as I could observe the stem, it was open at the top; and, when it bifurcated to form two branches,

both were open at their extremities, but the fleshy central matter had nowhere developed itself as yet into the form of a polypus. Polypi, therefore, are not the first-formed parts of this zoophyte, but are organs which appear long after the formation of the root and stem, as the leaves and flowers of a plant." *Professor Grant.*

2. P. CRISTATA, *shoots simple, plumous, the pinnæ alternate; cells in a close row, cup-shaped with a toothed margin and a short lateral spine; vesicles gibbous, girt with crested ribs.* Ellis.

PLATE XXIII. Fig. 1—3.

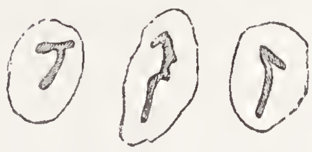
The Podded Coralline, *Ellis* Corall. 13, no. 12, pl. 7, fig. *b*, *B*.—Sertularia pluma, *Lin.* Syst. 1309. *Pall.* Elench. 149. *Ellis* and *Soland.* Zooph. 43. *D. Chiaie* Anim. s. Vert. Nap. iv. 145. *Esper* Pflanz. Sert. tab. 7, fig. 1, 2. *Oliv.* Zool. Adriat. 289. *Lister* in Phil. Trans. an. 1834, 369, pl. 8, fig. 2.—Aglaophenia pluma, *Lamour.* Cor. Flex. 170. Corall. 75. *Krauss* Corall. und Zoophyt. der Sudsee, 25.—Plumularia cristata, *Lam.* Anim. s. Vert. ii. 125: 2de édit. ii. 161. *Templeton* in Mag. Nat. Hist. ix. 467. *Risso* L'Europ. mérid. v. 313. *Hassall* in Ann. and Mag. N. Hist. vi. 169; and vii. 285. *Couch* Zooph. Cornw. 15: Corn. Faun. iii. 31, pl. 8.—Pl. pluma, *Flem.* Brit. Anim. 546.—Sertolaria pluma, *Cavol.* Pol. mar. 210, tav. 8, fig. 5-7.

Hab. On Fuci, particularly on Halidrys siliquosa, and sometimes "on muscles and other shells." Common on the southern coasts of England. On the Bootle coast, rare, *Mr. Tudor.* Ayrshire, *Rev. D. Landsborough.* On the coast of Ireland, near Dublin, *Ellis.* Found around the coast of Ireland, whence all the specimens which have come under my observation were on Halidrys siliquosa, *W. Thompson.*

Attached to sea-weeds by a flexuous horny anastomosing tubular fibre, which throws up, at intervals, plumous shoots from one to three inches high: these are very elegant and erect when in the sea, but when dry become curved in a falcate manner with all their pinnules, which are also frequently laid to one side. "Siccatione surculi sursum seu contrario modo quam fuerant, recurvantur, pinnulæque curvatæ ad invicem accedunt." *Pallas.* The polypidom is of a honey-yellow colour with a dark-brown rachis, which is smooth, and divided by numerous oblique septa or joints, there being one between every pair of pinnæ. Pinnæ alternate, close, parallel, celluliferous on the upper side; the cells separated by a joint and set in a sort of indentation in the stalk. They have been aptly compared by Ellis to the flower of the lily of the valley, being of a campanu-

late form, with the rim cut into about eight equal teeth, while in front there is a stronger spinous process which does not project beyond the cell. The ovarian vesicles are large and remarkably curious: they are produced both from the main stalk and pinnæ, are shortly pedicellate, and resemble a swollen pod girded round with from five to nine cristated ribs or bands proceeding from a dorsal tube, and rising into short spines on the anterior margin. When recent, "they are translucent, and six or seven dark oval masses can be seen within each. These seemed to be ova. The vesicle being torn up, and the ova allowed to escape, they were seen to be in form irregularly oval, but containing an opaque elongated body in their centre. Fig. 15. The form of this central body varied in different ova, but it was generally somewhat hammer-shaped. Neither the general mass of the ovum, nor this central body, were seen to move." *Dr. Coldstream,* June 10, 1833.—Polypes "minute, delicate; tentacula 10, annulated; mouth infundibuliform." *D. Coldstream.*

Fig. 15.



"Each plume," says Mr. Lister, in reference to a specimen of this species, "might comprise from 400 to 500 polypi;" and a specimen, of no unusual size, before me has twelve plumes, with certainly not fewer cells on each than the larger number mentioned, thus giving 6000 polypes as the tenantry of a single polypidom! Now, many such specimens, all united too by a common fibre, and all the offshoots of one common parent, are often located on one sea-weed, the site then of a population which nor London nor Pekin can rival! But Pl. cristata is a small species; and there are single specimens of Pl. falcata, or Sertularia argentea, of which the family may consist of 80,000 or 100,000 individuals. It is such calculations, always underrated, that illustrate the "magnalities of Nature," and take us by surprise, leaving us in wonderment at what may be the great object of this her exuberant production of these "insect-millions peopling every wave." But

"So He ordain'd, whose way is in the sea,
His path amidst great waters, and his steps
Unknown;—whose judgments are a mighty deep,
Where plummet of Archangel's intellect
Could never yet find soundings, but from age
To age let down, drawn up, then thrown again,
With lengthened line and added weight, still fails;
And still the cry in Heaven is, 'O the depth!'"—*Montgomery.*

I have a specimen of Pl. cristata gathered in Cork Bay, and presented to me by J. V. Thompson, Esq., which is nearly three inches in height, spreading laterally, the rachis divided in a regular dichotomous manner, and rough or muricated on one side, wherever it is naked of pinnæ. The vesicles have from seven to nine crested ribs, with a spinous dorsal keel. The roughness of the rachis is produced by the remains of the deciduous pinnæ. I give a figure of this specimen (Plate XXIV. fig. 1) as an additional proof that little reliance can be placed on external habit as a character in determining the species of this order.

Another variety imitates the habit of Pl. pennatula. The cells in it have a strong process on the distal side, which, springing from near the middle, projects beyond the rim; and the vesicles are larger and more numerously ribbed than is usual (Fig. 16). This variety,

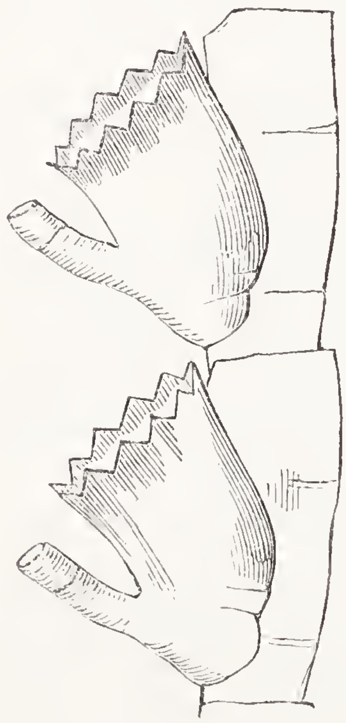


Fig. 16.

which Mr. Couch has also noticed, appears to be a denizen of deep water. My specimen was dredged in 30 fathoms, by Professor E. Forbes, off the Isle of Mull.

3. P. PENNATULA, *pennated; cells approximated, cup-like with an unequally-crenated margin, supported on the under side by a lengthened incurved spinous process.* G. Montagu.

PLATE XXII. Fig. 1, 2.

Sertularia pennatula, *Ellis* and *Soland.* Zooph. 56, tab. 7, fig. 1, 2. *Fleming* in Edin. Phil. Journ. ii. 83.—Aglaophenia pennatula, *Lamour.* Cor. Flex. 168. *Krauss*

Corall. und Zoophyt. der Sudsee, 25.—Plumularia pennatula, *Lam.* Anim. s. Vert. ii. 128 : 2de édit. ii. 165. *Flem.* Brit. Anim. 546. *W. Thompson* in Ann. Nat. Hist. v. 251. *Couch* Zooph. Cornw. 16 : Corn. Faun. iii. 33.

Hab. Coast of Devonshire, rare, *Montagu.* "On the Pinna ingens, deep water, rare," Cornwall, *Couch.* Also from the Corwich crab, and from the stems of Laminaria digitata, *C. W. Peach.* "Specimens of this rare and beautiful species profusely invest about six inches of the stem of a *Laminaria digitata* obtained in a fresh state by Miss M. Ball, at Youghal, in 1837," *W. Thompson.* West coast of Ireland, near Roundstone in Galway, *W. M'Calla.*

"This coralline is as remarkable for the elegance of its form, as its likeness to the feather of a pen." The polypidom is attached by a wrinkled anastomosing fibre, and rises occasionally, even in our seas, to the height of five inches : it is simply pennated, and very graceful. Rachis filiform, straight, naked below, of a darker colour than the yellowish-brown pinnæ : these are close-set, alternate, erecto-patent, either spreading out or secund : cells regularly placed, with a joint between each, rather small, sub-erect, cup-shaped, with a wide aperture, whose margin is sinuated or waved, "with a little spine on each side ;" and they are seated in the axil of a long tubular incurved process, which rises much above them.

Lamouroux has conjectured that the Pl. pennatula of Fleming is only a repetition of Pl. myriophyllum ; and Milne-Edwards refers it to Pl. cristata. I cannot see the slightest foundation for these suspicions.

"That variety of the Podded Coralline (Pl. cristata), which has the lengthened sub-marginal spine, bears a great resemblance to this species. But it is distinguished from it, by the cells being on the upper margin of the pinnæ, deeply tubular, by the regularity and decided manner in which the margin is dentated, and by the spine, though long, projecting from the side of the cell, leaving a space between it and the margin of the mouth, which is not the case in this species." *R. Q. Couch.*

4. P. PINNATA, *stem plumous, the pinnæ alternate, three on each internode ; cells rather distant, campanulate, leaning, the rim entire ; vesicles pear-shaped.* Dillenius.*

* Born in 1687, at Darmstadt, in Germany ; came to England in 1721 ; and died at Oxford, in 1747. He was the first Professor of Botany there, and has not been equalled in celebrity by any successor. It is unnecessary to give particulars of so eminent a man. For his life I may refer the reader to Pulteney's Sketches, v. ii.,

PLATE XXI. Fig. 4, 5.

Fucoides setis minimis indivisis constans, *Raii* Syn. i. 39, no. 7, tab. 2, fig. 2, lit. *a.* (injured and deprived of the pinnæ.)—Sertularia pinnata, *Lin.* Syst. 1312. *Ellis* and *Soland.* Zooph. 46. *Oliv.* Zool. Adriat. 290.—Aglaophenia pinnata, *Lamour.* Cor. Flex. 172.—Plumularia pinnata, *Lam.* Anim. s. Vert. ii. 127 : 2de édit. ii. 164. *Risso* L'Europ. mérid. v. 313. *Johnston* Trans. Newc. Soc. ii. 260 ; and in Mag. Nat. Hist. vi. 498. *Hassall* in Mag. and Ann. N. Hist. vii. 285. *Macgillivray* in Ibid. ix. 464. *Couch* Zooph. Cornw. 17. Corn. Faun. iii. 34.

Hab. On shells, stones, and other corallines in deep water.

In general about one inch and a half, but sometimes attains the height of four, or even six inches, very delicate, of a white, or, rarely, horn colour, simple, plumous, and pretty. The rachis is compressed, straight, jointed, the internodes about six times longer than their diameter, and each giving origin to three pinnæ, in which character I find a ready distinction between this and the following species. There is a minute tooth-like spine, only visible under the microscope, between the cells, which are perfectly transparent, and admit a distinct view of the polypes. These have a reddish body and numerous tentacula. The vesicles are rarely produced, but then profusely, and most of the specimens on which I have seen them have lost almost all their polypiferous pinnæ. At the base of the remnants they occur clustered, and are pear-shaped, with an aperture which, after the expulsion of the ova, is cut into a circle of spinous teeth, or, as Ellis expresses it, "the tops of the ovaries are divided like a coronet."

Plumularia pinnata, Mr. Hassall observes, "is generally found growing on a long filamentous sea-weed, up the stem of which it creeps often for more than a foot in extent, and round which the root-fibres form a complete sheath. The specimens thrown up by the sea are usually denuded of the short branches which proceed from the pinnæ. The vesicles are produced in great abundance, pyriform, blunt and plain above : each vesicle contains three or four dark-coloured ova."

Mr. Peach has specimens with five, four, and three pinnæ on the internodes of the stem, and all proceeding from the same polypidom. The specimens are from deep water, and are remarkably fine.

p. 154, &c. ; Thomson's Hist. Roy. Soc. p. 26 ; and Brewster's Edin. Encyclopædia, v. vii. p. 742 ; a good article contributed by my worthy friend Dr. Neill. Haller's notice of his friend is short, but interesting ; Bib. Bot. v. ii. p. 124 : and not less so the eulogium of his admirer, Dawson Turner. Richardson's Correspondence, p. 210.

5. P. SETACEA, *pinnate, the pinnæ alternate, one originating at each ringed joint of the rachis; cells very remote, campanulate, with an even margin; vesicles elliptical, smooth.* Ellis.

PLATE XXII. Fig. 3—5.

Sea Bristles, *Ellis* Corall. 19, no. 16, pl. 11, fig. *a*, *A*.—Corallina setacea, *Ellis* Corall. 38, fig. 4.—Sertularia pinnata β, *Lin.* Syst. 1312. *D. Chiaie* Anim. s. Vert. Nap. iv. 144.—S. setacea, *Pall.* Elench. 148. *Ellis* and *Soland.* Zooph. 47. *Lister* in Phil. Trans. an, 1834, 371, pl. 8, fig. 4.—Aglaophenia setacea, *Lamour.* Cor. Flex. 272.—Plumularia setacea, *Lam.* Anim. s. Vert. ii. 129: 2de édit. ii. 165. *Flem.* Brit. Anim. 547. *Templeton* in Mag. Nat. Hist. ix. 467. *Stark* Elem. ii. 440. *Risso* L'Europ. Mérid. v. 313. *Hassall* in Ann. and Mag. N. Hist. vii. 285. *Couch* Zooph. Cornw. 16: Corn. Faun. iii. 33.

Hab. Parasitical on other corallines, common.

In favourable sites this coralline will sometimes attain a height of six inches; but in general it is smaller, more delicate, and less plumous than Pl. pinnata, with which it has been confounded, although its habit and minuter characters prove it to be quite distinct. The stem is somewhat waved and regularly jointed, the joints consisting of two or three rings, and immediately under each joint the internode is somewhat enlarged in consequence of the pinna originating there, a single pinna only springing from under each joint; whereas in P. pinnata, as already remarked, three pinnæ proceed from each interspace, the joints of which, moreover, consist of a single fracture. The pinnæ are jointed like the stem, celliferous, the cells small and distant. At the base of each there is a minute tubular process (abortive cell ?), visible only with a high magnifier. The vesicles are elliptical, smooth, with a narrow plain orifice, and originate in the axils of the pinnæ.—"The ova within were opake and yellow. Its polypi had from sixteen to nineteen arms, and when they were full blown it was an object of remarkable beauty." *Lister.*—"The upper part of the vesicles of this species is prolonged into a short tube, affording an additional distinctive character between it and *Pl. pinnata,* which it so closely resembles." *Hassall.*

6. P. CATHARINA, *stem plumous, the pinnæ opposite, bent inwards; cells distant, campanulate, with an even margin; vesicles scattered, pearshaped, smooth.* G. J.

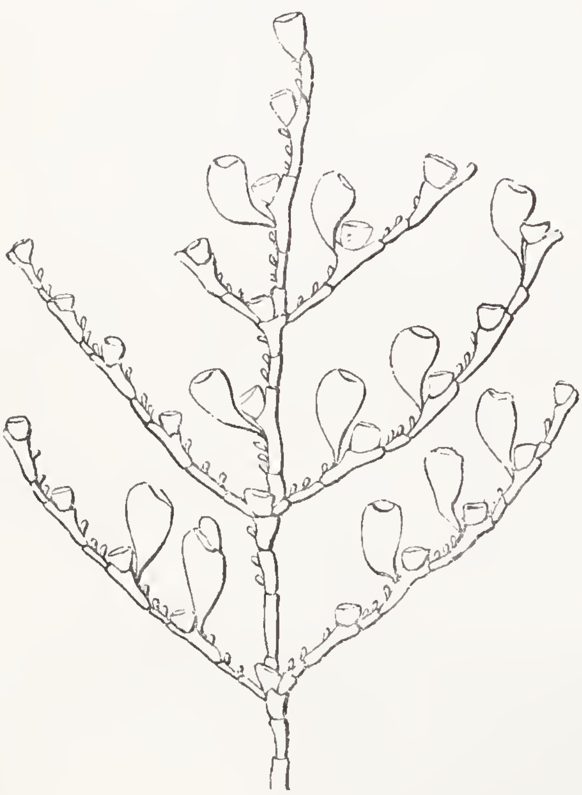
VIGNETTE, No. 1, page 3.

Plumularia Catharina, *Johnston* in Mag. Nat. Hist. vi. 498, fig. 61, 62. *Hassall* in Ann. and Mag. Nat. Hist. vii. 285. *Macgillivray* in Ibid. ix. 465. *Couch* Zooph. Cornw. 18: Corn. Faun. iii. 35.

Hab. On old shells, corallines, and ascidia in deep water. At Scarborough, rare, *Mr. Bean.* Frith of Forth, *Dr. Coldstream.* Frequent in Berwick Bay, *G. J.* Coast of the Isle of Man, *E. Forbes.* " Frequently trawled up off Howth and Lambay, in deep water, and but rarely cast upon the shore," *Hassall.* Coast of Cornwall, common, *Couch.* Near Aberdeen, " often brought up by the fishing-lines from deep water," *J. Macgillivray.* Lamlash Bay, *Rev. D. Landsborough.* " Several specimens were dredged from about forty fathoms at Sana Island, near the Mull of Cantire, by Mr. Hyndman, in June 1842 : one specimen springs from the stem of Thuiaria articulata." *W. Thompson.*

This equals Pl. pinnata in size and delicacy, but differs from it very obviously in having opposite pinnæ, which, instead of being arched, bend inwards, so as to render the general form of the coralline concave on a front view ; an appearance produced by the pinnæ originating, not from the sides, but from the anterior face of the stem. The stem itself is straight or slightly bent, jointed, pellucid, filled with a granular fluid matter ; and, in which it differs from its congeners, bearing cells ; there being always one at the base and between the insertion of the pinnæ, and generally another on the interval between them. Between the cells there is a series of minute tubular or tooth-like cells, visible only with a high magnifier. The ovarian vesicles are produced in summer : they are stalked, shaped like a pear or vase, solitary, scattered, and originating always at the base of a polype cell. From the intermediate cellules, particularly from the one next the polype cell, there often grows up a small trumpet-like tube ; and I have seen, in one specimen, all the ends of the branches terminated by four of these tubes diverging in pairs.—Mr. Peach has sent me specimens of Pl. Catharina from Cornwall, in which the stem is simple, or rather where there is no stem, but a development

Fig. 17.



of branches from a rootlike fibre. In these specimens, of course, several of the distinguishing characters were wanting, but the species was easily to be recognised by the cells and ovarian capsules. This variety, Mr. Peach says, is constant : "the stems are in clusters, and rise from trailing roots."

To this very distinct and elegant species I have taken the liberty of assigning the Christian name of the lady to whom this work is indebted for by far the greater portion of its illustrations.

* * Stem composed of many parallel tubes.

7. P. myriophyllum, *clustered, the stems undivided, bellied at distant intervals, pinnate ; pinnæ leaning to one side ; cells shortly tubular, seated in the axil of a curved spinous process, the aperture wide and nearly even.* Ellis.

Plate XXIII. Fig. 4, 5.

Corallina fruticosa pennata, *Petiv.* Plant. Ital. tab. 2, fig. 11.—Pheasant's-tail Coralline, *Ellis* Corall. 14, no. 13, tab. 8, fig. *a. A.*—Sertularia myriophyllum, *Linn.* Syst. 1309. *Pall.* Elench. 153. *Ellis* and *Soland.* Zooph. 44. *Berk.* Syn. i. 217. *Don's* Pl. and Anim. of Forfar, 36. *Esper* Pflanz. Sert. tab. 5, fig. 1—3. *Oliv.* Zool. Adriat. 288. *D. Chiaie,* Anim. s. Vert. Nap. iv. 145.—Aglaophenia myriophyllum, *Lamour.* Cor. Flex. 168.—Plumularia myriophyllum, *Lam.* Anim. s. Vert. ii. 124 : 2nd édit. ii. 159. *Flem.* Brit. Anim. 547. *Templeton* in Mag. Nat. Hist. ix. 466. *Stark* Elem. ii. 440. *Risso* L'Europ. Mérid. v. 312. *Blainv.* Actinolog. 477, pl. 83, fig. 4. *Landsborough* in Scott. Christ. Herald for April 1840, 244. *Hassall* in Ann. and Mag. N. Hist. vii. 285. *Couch.* Zooph. Cornw. 18 : Corn. Faun. iii. 36, pl. 9.

Hab. Deep water, rare. Near Dublin, *Ellis.* Coast of Devonshire, *Dr. Coldstream.* "Found by R. Brown, Esq., on the shore at Ballycastle. In Dublin Bay," *Templeton.* Youghall, *Miss Ball.* Dredged from forty fathoms' water at Sana Island, *Mr. Hyndman.* Off Whitehead, Belfast Lough, *W. M'Calla.* Coast of the Isle of Man, *E. Forbes.* Lamlash, coast of Ayrshire, *Rev. D. Landsborough.* Coast of Cornwall, occasionally parasitical on the Spider and Corwick Crabs, *Charles W. Peach.* Near Aberdeen, *J. Macgillivray.* "Of this I have only found one specimen on this coast" (Angusshire), *Mr. Don.*

This polypidom is very beautiful, eminently plumous, of a yellowish colour, and six inches or more in height. The roots are matted together with numerous entangled fibres. Stalk as thick as a crow-quill, yellowish-brown, straight or slightly curved, swollen at intervals on the back, and simple or once divided : it is composed of

a number of tubes bound together, as is easily seen on a transverse section, and the oblong dorsal knobs seem to be produced by a less close adhesion of the tubes at these places, "marking probably the stages of growth." The branches or pinnæ spring from both sides, beginning about the middle of the stalk, the lower part being naked, but they incline, in general, so much one way as to appear unilateral, or secund. The wide cylindrical cells are divided from each other by a joint, and are seated in the axil of a curved spinous process which projects far enough to form a short tooth at the under side of the aperture.—When dry, the stalk is twisted, and more distinctly perceived to be composed of a bundle of tubes, and consequently furrowed. In each of the furrows there is a row of small holes with a raised brim, as if punctures had been made by an instrument pushed from within. The holes are close-set, and regular in their size, form, and in the distances between them. No probable conjecture of the use of these has yet been made.

The Rev. D. Landsborough's Scottish specimen is eighteen inches in height. "In another respect, I think the Plumularia must be unusually fine. One of its general characteristics is, that its pinnæ, or plumules, lean so much to one side, that it has the appearance of being unilateral, and, consequently, like a feather shorn on one side of its rays. In this specimen, the plumules, instead of leaning to one side, proceed uniformly from the stem in opposite directions; and, as the plumules on each side of the stem were upwards of an inch in length, and of a silvery colour in the water, handsome feathers were thus formed, fitted to vie even with those in the tail of the beautiful silver pheasant."

8. P. frutescens, *stem branched, the branches pinnate; pinnæ alternate, bifid; cells infundibuliform, leaning, rather distant, the mouth plain.* Ellis.

Plate XXIV. Fig. 2, 3.

Sertularia Gorgonia, *Pall.* Elench. 158—S. frutescens, *Ellis* and *Soland.* Zooph, 55. pl. 6, fig. a, A. and pl. 9, fig. 1, 2, encrusted with a Gorgonia. *Rees*, Cyclop. Vermes, pl. 8, fig. 3. *Turt.* Brit. Faun. 214. *Hogg's* Stock. 33.—Aglaophenia frutescens, *Lamour.* Cor. Flex. 173. *Krauss* Corall. und Zoophyt. der Sudsee, 26.—Plumularia frutescens, *Flem.* Brit. Anim. 547. *Lam.* Anim. s. Vert. 2de édit. ii. 166. *Blainv.* Actinolog. 477.—*Hassall* in Ann. and Mag. N. Hist. vii. 285, pl. 8, fig. 1. *Couch* Zooph. Cornw. 19: Corn. Faun. iii. 37.

Hab. Found at Scarborough, in Yorkshire, *Ellis,*—whence I have

specimens from *Mr. Bean*, who states that it inhabits deep water, where it grows attached to stones and shells by a fibrous base, and is very rare. Hartlepool, Durham, *J. Hogg, Esq.* Cullercoates, Northumberland, *J. Alder*. On the rocks at Whitburn near Sunderland, *Miss Dale*. Youghal, *Miss Ball*. Dublin Bay, very rare, *A. H. Hassall*. Cornwall, apparently not rare, *Couch*.

Polypidom between four and five inches in height, firm and woody, black or dusky-brown, varnished, irregularly branched. Stem and branches tapered, composed of many parallel twisted capillary tubes, the branches erecto-patent, spreading laterally, pinnate ; pinnæ rather close, alternate, two or three from each space between the joints, and each divided into two branches. Cells rather distant, adnate, cylindrical, widening outwards, smooth, with an entire slightly everted margin : there is a small cell in the axils of the pinnæ, and a denticle at the base of all the cells, each of which occupies a joint. Vesicles scattered, small, pear-shaped, the rim of the opening plain.

"The vesicles are numerously produced in March and April, on the upper edges of the pinnæ. They are small, ovoid, with prolonged terminal apertures." *Couch*.

FAMILY—CAMPANULARIADÆ.

Genus SERTULARIÆ pars, *Lin. Pall. Solander*.—Genus CAMPANULARIA, *Lamarck*, Anim. s. Vert. ii. 112.—Family SERTULARIES pars, *Lamour*. Expos. Method. 9. —SERTULARIADÆ sect. ii. *Flem*. Brit. Anim. 538.—SERTULARIS pars, *Blainv*. Actinolog. 472. — CAMPANULARIADÆ, *Johnston* in Trans. Berk. Club, p. 107. *Gray* Syn. Brit. Mus. 76.—Les CAMPANULAIRES, *Van Beneden*. Mem. p. 11—38.

CHARACTER.—*Polypidoms plant-like, horny, rooted by a creeping tubular fibre, branched or simple ; the Polype-cells thin and campanulate, terminal, elevated on a ringed foot-stalk, disposed either alternately or irregular : ova in horny deciduous capsules. Polypes with a single series of filiform tentacula ; the mouth proboscidiform. Embryo medusiform.*

13. LAOMEDEA,* Lamouroux.

CHARACTER.—*Polypidom rooted by a creeping fibre, plant-like, erect, jointed at regular intervals, the joints ringed, incrassated, giving origin, alternately from opposite sides, to the shortly pedicled cells : Cells campanulate : Vesicles axillary. Polypes hydraform.*

* Λαομέδεια,—the name of one of the Nereids, according to Hesiod's Theogony, v. 257.

1. L. DICHOTOMA, *stem filiform, flexuous, incrassated below the joints and ringed above them, branched, the branches alternate, from the bend of the joints; cells campanulate, on ringed tapered pedicles; ovarian capsules axillary, ovate, smooth.* Ellis.

Var. α. Polypidom dichotomously branched, diffuse.

Var. β. Polypidom slender and elongate, pyramidal, alternately branched, the branches erecto-patent or spreading.

Var. γ. Polypidom irregularly branched, the branchlets pinnate.

PLATE XXVI. FIG. 1, 2.

Sea-thread Coralline, *Ellis* Corall. 21, no. 18, pl. 12, fig. *a*, *A*.—Corallina filiformis ramosa, pedunculis calyculorum contortis, *Ellis* Corall. pl. 38, fig. 3.—Sertularia dichotoma, *Lin.* Syst. x. 812. *Lin.* Syst. 1312. *Ellis* and *Soland.* Zooph. 48. *Berk.* Syn. i. 218. *Jameson* in Wern. Mem. i. 564. *Turt.* Brit. Faun. 215. *Stew.* Elem. ii. 446. *D. Chiaie* Anim. s. Vert. Nap. iv. 146. *Oliv.* Zool. Adriat. 289.—Sertularia longissima, *Pall.* Elench. 119,—a name which, as Olivi has remarked, is preferable to that of Linnæus, but the latter has the claim of priority.—Laomedea dichotoma, *Lamour.* Cor. Flex. 207. *Risso* L'Europ. Mérid. v. 314. *Blainv.* Actinolog. 474. *Couch* Zooph. Cornw. 20: Corn. Faun. iii. 37. *Macgillivray* in Ann. and Mag. N. Hist. ix. 465—.Campanularia dichotoma, *Lam.* Anim. s. Vert. ii. 113; 2de édit. ii. 132. *Flem.* Brit. Anim. 548. *Risso* L'Europ. Mérid. v. 309. *Grant* in Edin. New Phil. Journ. i. 151. *Grant* in Cyclop. Anat. and Phys. i. 108, fig. 30. *Grant* Comp. Anat. 10, fig. 5. *Johnston* in Trans. Newc. Soc. ii. 255. *Stark* Elem. ii. 441. *Templeton* in Mag. Nat. Hist. ix. 469.

Hab. On old shells, and other submarine bodies within tide-mark, common. I frequently find it on the branches of trees that have been carried by floods into the sea.

Polypidom confervoid, erect, rising to the height of from twelve to twenty-four inches, rooted by a creeping flexuous fibre: the stem filiform, percurrent, flexuous or zig-zag, giving off from every bend a short branch which, when perfect, is a miniature copy of the entire polypidom. The branches are alternate, erecto-patent, arising from a sort of rest at the joints in the stem, where it is perceptibly thickened; and it is ringed immediately above the joints, as is likewise the base of the branches. The branches from the lower and mid parts of the stalks are all about equal in spread, but they become gradually shorter as they approach the top, so that the whole figure is somewhat pyramidal. Pedicles of the cells annular throughout, tapered, generally about three times the length of the cell, which is very exactly campanulate, with thin membranous parietes and an even rim. Ovarian vesicles very shortly stalked, axillary, pear-shaped, smooth, opening on the top with a plain

circular, more or less elevated aperture: they are commonly produced in spring.

The polypes are reddish; and the cells, within which they nestle, so hyaline and tender, that specimens gathered amongst the rejectamenta of the sea are mostly deprived of them.

Pallas has most aptly described this species, and I quote a part of his description to render our own more complete:—"*Substantia* stirpis junioris, extremorumque maxime ramulorum cum calyculis albida, mollis, tenera; adultioris, per truncum et principaliores ramos, testacea, versus ramos sensim dilutior et tenerior; tandemque antiquæ et mortuæ atra corneaque, superstitibus tantum ramis principalioribus, (ut *Ellis tab.* 12, *a. A.*)"

2. L. GENICULATA, *stem zig-zag, simple, rarely with one or two branches; cells on annular stalks from the joints, campanulate, with an even-rim; vesicles axillary, ovate.* Doody.

PLATE XXV. FIG. 1, 2.

Fucoides setaceum tenuissime alatum, *Raii* Syn. i. 38, no. 6, pl. 2, fig. 2.—*Ellis* in Phil. Trans. abridg. x. 491, pl. 12, fig. 1, *a. A.*—Knotted-thread Coralline, *Ellis* Corall. 22, no. 19, pl. 12, *b. B.*—Sertularia geniculata, *Lin.* Syst. 1312. *Pall.* Elench. 117. *Müll.* Zool. Dan. iii. 61, tab. 117, fig. 1—4. *Ellis* and *Soland.* Zooph. 49. *Lam.* Anim. s. Vert. ii. 120: 2de édit. ii. 149. *D. Chiaie* Anim. s. Vert. Nap. iv. 143.—Laomedea geniculata, *Lamour.* Cor. Flex. 208. *Couch* Zooph. Cornw. 20: Corn. Faun. 38, pl. 10, fig. 1.—Campanularia geniculata, *Flem.* Brit. Anim. 548. *Johnston* in Trans. Newc. Soc. ii. 255. *Van Beneden* Camp. 34, pl. 3, fig. 1—6.—Monopyxis geniculata, *Ehrenb.* Corall. des roth. Meer. 73.

Hab. Parasitical and gregarious on sea-weeds that grow near low-tide mark, especially on the frond of Laminaria digitata; very common. "Some of the finest specimens I have seen were growing on the dorsal and caudal fins of a Picked Dogfish." *R. Q. Couch.* "It is sometimes found on Zostera marina, but is common on Algæ, especially on Halidrys siliquosa and Laminaria digitata. The incipient state appears very different on these two plants. The roots (if so they may be termed) twine round the stem and vesicles of the Halidrys in an ordinary manner, so as not to attract attention; but on the broad leaves of the Laminaria they often form a regular piece of network, having meshes of various size, with their junction tied in a knot, as it were by fairy fingers. From each knot, in due time, springs the zoophyte known as L. geniculata." *W. Thompson.*

Polypidom attached by a creeping tubluar thread, erect, about

an inch in height, simple or sometimes sparingly branched, regularly zig-zag, slender and flexile, of a clear white colour, often tinted more or less with rose-red, and filled with a dusky granular pulp: the stem, at every flexure, is divided by a single joint and incrassated, a twisted pedicle originating from the incrassated part alternately from opposite sides; the pedicle consists of 4-6 nearly equal rings, is erecto-patent, tapered slightly and terminated with a bell-shaped cell, perfectly transparent and entire. The polypes, according to Müller, have twenty-four tentacula;* Mr. Couch says they vary "from fourteen to twenty-eight;" and Van Beneden states the number to be only sixteen. The vesicles are to be found throughout the summer: they originate from the incrassation of the joints at the side of the cells, and resemble an elegant Greek vase or urn, being of an elliptical or ovate shape, with a very short tubular opening on the flattened apex. The ova are comparatively large.

The polypidom is occasionally tinted of a pink or rose-red colour, —an accident which is not unfrequent with the Sertularians in general, especially with Sertularia abietina and pumila. On what the colour depends has not been ascertained. Some specimens so tinted retain the colour after being dried, while others lose it. The nature of the *habitat* has apparently no influence on it, for I have often observed coloured and colourless specimens on the same stone and sea-weed. The specimens are sometimes only partially coloured, red in one portion, and of the ordinary yellowish-brown hue in another: "in such instances as have come under my observation, the red was generally, if not always, the basal portion." *W. Thompson.*

3. L. gelatinosa, *stem filiform, elongate, branched, the branches divaricate, scattered, panicled; cells on rather long pedicles, campanulate, with an even rim.* Dillenius.

Plate XXV. Fig. 3, 4.

Var. α. Stem a single tube, subramose.
Var. β. Stem compound, ramous. Plate XXVII. Fig. 1.

Corallina confervoides gelatinosa alba, geniculis crassiusculis pellucidis, *Raii* Syn. i. 34, no. 7.—Corallina filiformis ramosa pedunculis calyculorum contortis, *Ellis* Corall. pl. 38, fig. 3; and p. 23, pl. 12, fig. c. *C.*—Sertularia gelatinosa, *Pall.*

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* "In perfecta animalis extensione duodecim tentacula posteriora reflexa cingunt cellulam, anteriora protensa in formam campanulæ radiatæ cingunt capitulum."—*Muller.*

Elench. 116. *Stew.* Elem. ii. 444. *Fleming* in Edin. Phil. Journ. ii. 84. *Flem.* Phil. Zool. ii. 616, pl. 5, fig. 3.—Laomedea gelatinosa, *Lamour.* Corall. 92. *Thompson* in Ann. N. Hist. v. 251. *Hassall* in Ibid. vi. 169. *Couch* Zooph. Cornw. 21: Corn. Faun. iii. 39, pl. 10, fig. 2.—Campanularia gelatinosa, *Flem.* Brit. Anim. 549. *Johnston* in Trans. Newc. Soc. ii. 254. *Van Beneden* Campan. 33, pl. 1 and 2.—Sertularia dichotoma, in part, *Lister* in Phil. Trans. an. 1834, 372, 375, pl. 10, fig. 1.—La Sertolara dictoma, *Cavol.* Pol. mar. 194, tav. 7, fig. 5—8.

Hab. On stones and sea-weeds between tide-marks. Sometimes parasitical on Zostera marina. It is very abundant on some parts of the Solway at low-water mark on a stony bottom, and becomes a great nuisance to the stake-nets, which require to be tidely cleared from the quantity that is caught by them. *Sir William Jardine.*

This species, in its most perfect state, rises to the height of eight or ten inches. The stem is as thick as small twine, straight, opake, and composed of many tubular threads twisted together. It does not properly divide itself, but sends off branches from all sides, which are either opposite or alternate, and much ramified into diverging branchlets, each of them marked with three or four rings at its base, and terminated with a bell-shaped polype-cell of a very thin corneous texture. A specimen of this description from Shetland, in the collection of my friend Dr. Coldstream, is figured in Plate XXVII.

But more commonly Laomedea gelatinosa is found in a much humbler condition, and under a guise that requires, for its discrimination from Laomedea geniculata, a careful examination. It occurs thus in Berwick Bay, growing gregariously on the sides and under-surface of stones lying in shallow pools between tide-marks, and seemingly giving a preference to those that contain an impure or brackish water. The shoots are all connected with one another by the radicle fibre, which creeps in an irregular manner along the rock; they are rarely above an inch in height, simple or sparingly branched, consisting of a single tube of a light corneous colour and texture, ringed above the origins of the long twisted filiform pedicles on which the polype-cells are raised. These cells are deeply cupped, transparent, with a wide even margin. Vesicles urn-shaped, smooth, shooting from the axils of the pedicles. They are matured during the summer months, when we find them filled with ova of a circular flattish form, marked with a dark speck in the centre. At first they fill scarcely half of the vesicle, but by their increase they soon come to occupy the whole cavity, and are ultimately extruded from the top; after which the empty vesicle

soon disappears. The ova while in the vesicle are arranged round a central placentular column, and the lid which closes the vesicle is a mere dilatation of this column, which appears to be composed of two pieces soldered together, and bulged at intervals, where perhaps the ova are more immediately affixed in their immature state.*

The polypes are little regardless of external irritations or injuries, and readily protrude themselves when submerged. They have from sixteen to twenty-six (Van Beneden says twenty-four) long filiform tentacula inserted beneath and around the oral disk; and under a good magnifier they appear rough with minute tubercles placed in close whorls. The edentulous mouth is in the centre of the tentacula, and assumes the shape sometimes of a rounded projecting tubercle, sometimes of a narrow column, and sometimes of a broad flat disk with a stricture under it simulating a neck. It leads directly to the stomachal cavity, which is large and undivided; and I have occasionally witnessed within it currents of a fluid filled with minute granules, as has been more fully noticed by Mr. Lister and Dr. Fleming.

Milne-Edwards, in the belief of there being a specific difference between the zoophytes described by Pallas and Fleming, has proposed to call the latter Campanularia Flemingii, distinguished by the cells having an even rim; whereas it is stated to be serrulated in the other. I have preferred following the judgment of Fleming, who has very carefully studied the species.

4. L. OBLIQUA, *simple, zig-zag, the cells on short stalks, campanulate, with the rim deeply sinuated on the proximal side.* W. W. Saunders.

PLATE XXVIII. FIG. 1.

Laomedea obliqua, *Saunders* in litt. 5 Jan. 1841.—Campanularia, *Lister* in Phil. Trans. an. 1834, 372, pl. 8, fig. 5.

Hab. Parasitical on sea-weeds. Brighton, *W. Wilson Saunders.*

The polypidom is affixed as usual by a creeping tubular fibre, from which numerous polypiferous shoots arise in an irregular man-

* The manner in which the gemmules are produced differs in the two species. In *L. geniculata* "the whole of the granular pulp is formed into the gemmules; then they escape, leaving the case empty; in this (*L. gelatinosa*) there is a central placentular column to which the gemmules are attached by an umbilical cord. The polypes are alike in both, and are liable to the same variations and irregularities in the number of their tentacula."—*R. Q. Couch.*

ner. These are about half an inch in height, simple, zig-zag, and of a pale horn colour ; and from every bend a cell originates alternately from opposite sides. The stem is divided at regular intervals, as in the other species ; but, instead of several rings or twists above the origin of the cells, there is a small internodial joint ; and the stalk of the cell, instead of being ringed, consists of two or three unequal joints, much as they are formed in the genus Halecium. The cell itself is of the normal thin hyaline texture, and bell-shaped; but the rim is sinuated on the proximal margin, so that the aperture resembles very much the mouth of a jug ; and it is this form that peculiarly distinguishes the species, and suggested the specific name to Mr. Saunders. Under the proximal side also there is a kind of articulated process adnate to the cell and projecting a little beyond the rim,—a structure analogous to that we observe in several species of Plumularia, and not hitherto noticed in any species of Campanulariadæ. There were no vesicles in the specimens which I received from Mr. Saunders.

The species is allied to the *Laomedea reptans* of Lamouroux. The polypes, according to Mr. Lister, have sixteen tentacula. The ovary is ovate, truncate above and plain, enormously large as compared with the cells.

14. Campanularia,* Lamarck.

Character.—*Polypidom rooted, creeping or, when compound, erect, the main tube filiform, continuous, giving off its pedunculated cells irregularly or in whorls ; pedicles ringed, usually long ; cells campanulate ; vesicles scattered, sessile. Polypes hydraform.*

* Stem a single tube.

1. C. volubilis, *stem creeping, filiform ; cells on long slender annular pedicles, campaniform with a serrated rim ; vesicles ovate, wrinkled concentrically.* Ellis.

Small climbing Coralline with bell-shaped cups, *Ellis* Corall. 24, no. 21, pl. 14, fig. *a. A.* Phil. Trans. xlviii. 629, pl. 22, no. 2. Phil. Trans. abridg. x. 491, pl. 12, fig. 2, *B.*—Polyporum species, *Bast.* Opusc. Subs. i. p. 41, tab. 2, fig. 1, *a*, and fig. 7, *b.*—Sertularia volubilis, *Lin.* Syst. 1311. *Ellis* and *Soland.* Zooph. 51, pl. 4, fig. *e, f, E. F.* copied into *Kirby's* Bridgew. Treat. i. pl. 2, fig. 2. *Berk.* Syn. i. 218. *Fabric.* Faun. Grœnl. 444. *Esper* Pflanz. Sert. tab. 30, fig. 1, 2. *Turt.*

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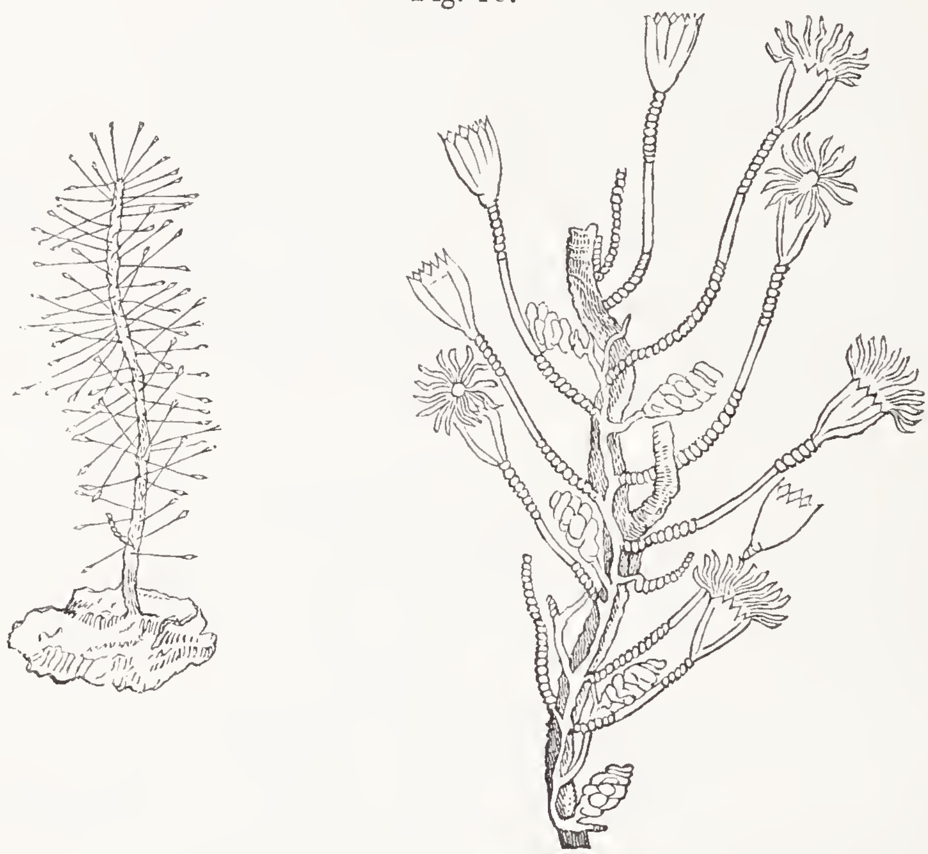
* From *Campanula*, a bell.

Brit. Faun. 214. *Stew.* Elem. ii. 444.—S. uniflora, *Pall.* Elench. 121. *Ellis* in Phil. Trans. lvii. 437, pl. 19, fig. 9.—Clytia volubilis, *Lamour.* Cor. Flex. 202. Expos. Meth. 13, pl. 4, fig. *e*, *f*.—Campanularia volubilis, *Lam.* Anim. s. Vert. ii. 113 ; 2de édit. ii. 132. *Flem.* Brit. Anim. 548. *Risso*, l'Europ. Mérid. v. 309. *Johnston* in Trans. Newc. Soc. ii. 255. *Templeton* in Mag. Nat. Hist. ix. 466. *Couch* Zooph. Cornw. 22 ; Corn. Faun. 40, pl. 11, fig. 1. *Van Beneden* Campan. 36, pl. 3, fig, 7, 8.—*Blainv.* Actinolog. 472, pl. 84, fig. 2.

Fig. 18.



Hab. Parasitical on other corallines and sea-weeds, frequent.

A minute species, and a beautiful object for the microscope. I have seen the antennæ of a crab (Lithodes spinosa) so profusely invested with this zoophyte as to resemble hairy brushes. The coralline in this instance had chosen a station by which it obtained all the benefits of locomotion. Our figure represents a specimen which had adorned in a similar manner the remnant of a Plumularia falcata. The stem is a capillary corneous tube which creeps and twists itself upon its support, throwing out, at alternate intervals, a long slender stalk twisted throughout or only partially, that supports a bell-shaped cup of perfect transparency and prettily serrulated round the brim. The ovarian vesicles arise from the creeping tube, are sub-pedicellate, ovate, coarsely wrinkled, and contain each several ova. Polypes with numerous slender white tentacula.

The stalks are sometimes almost even and smooth, with a few distant septa, and a single rounded joint just below the cell. Mr.

Couch's observation, that "the animal possesses the power of corrugating the whole," readily explains this variation in its appearance.

"This elegant microscopic sepcies is furnished with a delicate joint or hinge, situated at the base of each little cup. This beautiful contrivance is designed, I imagine, to enable this frail zoophyte the better to elude the rude contact of the element by which it is surrounded, by permitting it to bend to a force which it cannot resist." *A. H. Hassall.*

2. C. INTEGRA, "*stem a single tube, filiform, creeping ; cells on long slender twisted pedicles, campaniform, with the rim entire ; vesicles— ?*" W. W. Saunders.

PLATE XXVIII. FIG. 2.

Campanularia integra, *Macgillivray* in Ann. and Mag. N. Hist. ix. 465.—Camp. lævis ? *Couch* Corn. Faun. 42.

Hab. "Don-mouth ; parisitical on Tubularia indivisa," *J. Macgillivray.* Hastings, *W. W. Saunders.* On stones and shells from deep water, Polperro, *R. Q. Couch.*

"This species, which I believe to be new, differs from the preceding in having cells with the rim *entire*, and not serrulated, as in *C. volubilis.* With *C. syringa*, the only other British species of the genus which has a single tube for a stem, it can never be confounded : the 'denser corneous texture, cylindrical tubular cells, and short pedicles' of *C. syringa* are perfectly distinctive." *J. Macgillivray.*

In January, 1841, I received specimens of this species from Mr. Saunders, named by him *C. lævis.* In habit, texture, and size, it resembles C. volubilis very exactly, but the rim of the cell is even and smooth. The stalk is twisted like a screw, except at the top, where there are four or five annuli, as represented in our figure. Of his *Camp. lævis* Mr. Couch says, that the cells are "on long slender *unringed* footstalks," but the even or ringed condition of the stalk affords no specific character. "The polype," he adds, "has eleven long and slender tentacula."

3. C. INTERTEXTA, "*texture spongy, composed of single tubular fibres very much interwoven with each other, not ringed ; cells campanulate, apertures even.*" R. Q. Couch.

Campanularia intertexta, *Couch* Corn. Faun. iii. 41, pl. 11, fig. 3.

Hab. Parasitical on Sertularinæ, not uncommon.

"This, which is, I believe, quite new, differs so remarkably from any of the kindred species, that it cannot easily be mistaken. It so closely resembled a very loose-textured sponge, that several specimens were laid aside for a time, till that class came under consideration. I have found many specimens encrusting the *Sertularia polyzonias, Campanularia dumosa,* and other corallines from deep water, about seven leagues from the Deadman, in a line S.E. to S.S.W. It encrusts or surrounds the stem and branches for about half an inch in length; it is ovoid, and formed of minute brown hollow tubes variously interwoven. The cells, which are minute, stand a little from the surface, and are campanulate with even truncated apertures. I have been unable to refer this to any described species, and have therefore proposed to call it *intertexta,* as descriptive of its appearance." *R. Q. Couch.* — This seems a doubtful zoophyte. I have seen many specimens, but none with cells.

4. C. syringa, *stem creeping, capillary; cells on shorter twisted pedicles, tubulous, with a plain operculated margin.* Ellis.

Fig. 19.

Creeping Bell-Coralline, *Ellis* Corall. 25, pl. 14, fig. *b. B.*—Sertularia syringa, *Lin.* Syst. 1311. *Berk.* Syn. i. 218.—S. volubilis, *Pall.* Elench. 122.—S. repens, *Ellis* and *Soland.* Zooph. 52.—Clytia syringa, *Lamour.* Cor. Flex. 203.—Campanularia syringa, *Lam.* Anim. s. Vert. 113; 2de édit. ii. 132. *Flem.* Brit. Anim. 548. *Johnston* in Trans. Newc. Soc. ii. 256. *Thompson* in Ann. Nat. Hist. v. 251. *Macgillivray* in Ann. and Mag. N. Hist. ix. 465. *Couch* Zooph. Cornw. 22: Corn. Faun. 41, pl. 11, fig. 2. *Hassall* in Ann. and Mag. N. Hist. vi. 169. *Van Beneden* Camp. 37, pl. 3. fig. 9. (opt.)

Hab. Parasitical on other corallines and the lesser fuci, not uncommon.

This is only to be distinguished from C. volubilis by the aid of the microscope. The two species frequently grow intermixed, and their habit is the same, but the syringa is easily distinguished by its denser corneous structure, its cylindrical tubular cells, and the shortness of the pedicles which support them. Polypes with eight filiform equal tentacula. What distinguishes this from every other species is its operculum,—a name which Van Beneden gives to a lid of a conical shape formed by a prolongation of the margin of the polype-cell. When folded down or drawn within the cell, the top of this appears truncated, as shown in our figures. Van Beneden delineates the polypes with at least ten tentacula.

5. C. LACERATA, *cells on short stalks, ovato-conical, the upper half cleft into six lanceolate segments.* G. J.

PLATE XXVIII. FIG. 3.

Hab. Parasitical on Plumularia falcata in Berwick Bay, *G. J.* At St. Andrew's, on Cellularia scruposa, *J. Reid.*

Cells arising from a slender tubular stem which creeps up the ramifications of other corallines, scattered, on very short pedicles consisting of four or five equal rings, ovate, the upper part of a conical form, and divided into six deep lanceolate segments, which, in our specimens, are all connivent, and form an acute apex. The texture of the cell is so thin and transparent that it is difficult to determine, in all cases, the exact number of these segments ; and in some cells Professor Reid observed two or three other linear segments to be attached. In one cell, in which the polype was contained, two of these segments crossed each other. " Polype hydraform : tentacula 16 or 17, with numerous whorls (about 20 in number) of small tubercles adhering to their outer surface. The polype can extend itself to a great length, even to more than twice the length of the cell. The circulation of nutritive juices in the pith of the pedicles, and the stomach of the polype, was very well seen." *Prof. John Reid.*

* * Stem composed of many parallel tubes.

6. C. VERTICILLATA, *erect, branched ; cells on verticillate pedicles, campanulate, with a serrulated rim.* Dr. Brownrigg.*

PLATE XXVI. FIG. 3, 4.

Horse-tail Coralline with bell-shaped cups, *Ellis* Corall. 23, no. 20, pl. 13, fig. *a. A.* —Sertularia verticillata, *Linn.* Syst. 1310. *Pall.* Elench. 115. *Ellis* and *Soland.* Zooph. 50. *Berk.* Syn. i. 218. *Hogg's* Stock. 34.—Clytia verticillata, *Lamour.* Cor. Flex. 202.—Campanularia verticillata, *Lam.* Anim. s. Vert. ii. 113 ; 2de édit. ii. 131. *Flem.* Brit. Anim. 550. *Templeton* in Mag. Nat. Hist. ix. 466. *Couch* Zooph. Cornw. 23 : Corn. Faun. iii. 42, pl. 11, fig. 4. *Hassall* in Ann. and Mag. N. Hist. vi. 169.—La Laomédée verticillée, *Blainv.* Actinolog. 475, pl. 84, fig. 3.

Hab. "Near Whitehaven, in Cumberland," *Dr. Brownrigg.* Near Hartlepool, Durham, not very frequent, *J. Hogg, Esq.* Not uncommon on the coast at Scarborough, adhering to shells, &c., *Mr. Bean.* Cullercoats, Northumberland, *Mr. Joshua Alder.* Rare in Cornwall ; not so much so in Devon ; more frequent in Norfolk, *W. C. Peach.* Blackrocks, Dublin, *A. H. Hassall.* Clyde off Cumbray, *E. Forbes.* Found commonly thrown ashore at Portmarnock in 1835, and subsequently : more rare, but of occasional occurrence, in deep water in Belfast Bay, *W. Thompson.* Magilligan, *Mr. Hyndman.*

Polypidom adhering by creeping tubulous fibres, erect, irregularly branched, the stem and branches composed of many closely applied parallel tubes ; branches erect or erecto-patent, cylindrical, straight, hirsute from the capillary pedicles of the cells which originate in whorls at stated intervals : the pedicles are ringed at top and bottom but generally smooth about the middle, patent, simple ; the cell itself campanulate, thin and transparent with a serrated brim. Vesicles scattered, arising from the branches, solitary, very shortly stalked, oval, smooth, with a narrow aperture.

* Dr. William Brownrigg, born at High Close Hall, Cumberland, March 24th, 1711 ; graduated M.D. at Leyden in 1737 ; elected F.R.S. in 1742 ; in 1748 published his valuable work on the art of making common salt ; received the Copley medal for the year 1765 ; continued to prosecute with zeal his chemical and philosophical experiments, and to enjoy his literary taste, until the period of his death, which took place at Ormathwaite, January 6, 1800, aged 88 years. For an able biographical account of this learned and excellent physician, see the Annals of Philosophy, vol. x. p. 321, &c.

7. C. DUMOSA, *erect or climbing, irregularly branched, hirsute with the cells, which are long, tubular, patent, almost sessile, the aperture entire.* Pallas.

PLATE XXVII. FIG. 2—5.

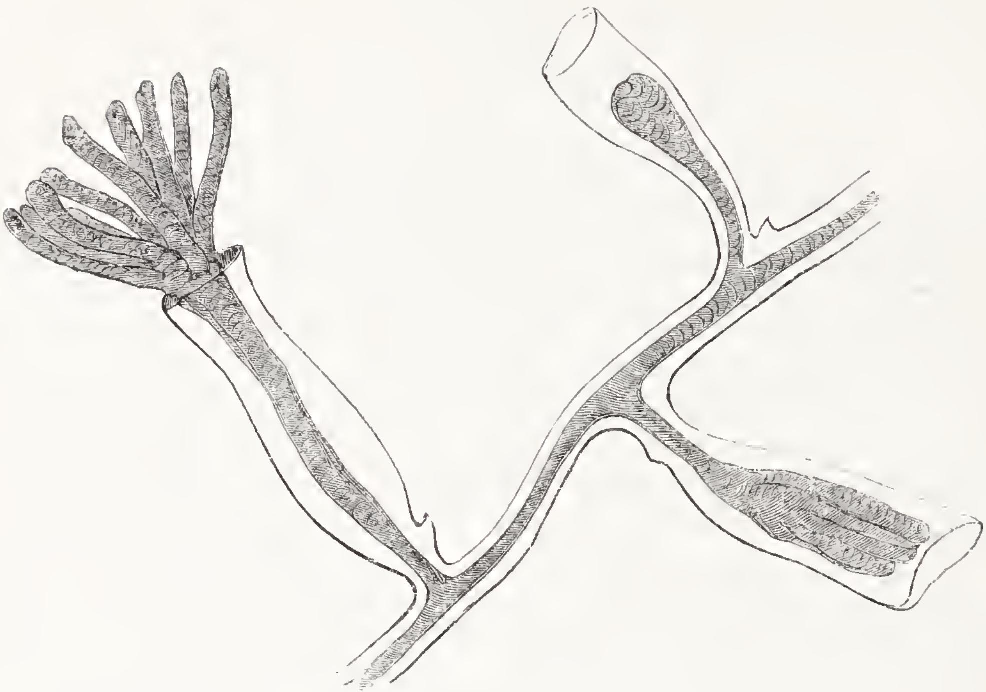
Corallina astaci corniculorum æmuli, *Petiv.* Plant. Ital. pl. 2, fig. 10.—Sertularia volubilis, β, *Pall.* Elench. 123.—Sertularia dumosa, *Fleming* in Edin. Phil. Journ. ii. 83.—Tubularia tubifera, *Johnston* in Edin. Phil. Journ. xiii. 222, pl. 3, fig. 2, 3.—Lafea cornuta, *Lamour.* Soland. Zooph. 5, pl. 65, fig. 12-14.—Campanularia dumosa, *Flem.* Brit. Anim. 548. *Johnston* in Trans. Newc. Soc. ii. 254, pl. 11, fig. 1. *Couch* Corn. Faun. iii. 42. *Reid* in Ann. and Mag. N. Hist. xvi. 393.—Cornularia dumosa, *Couch* Zooph. Cornw. 39.

Hab. On rocks, shell-fish, and other corallines, in deep water.

There are two varieties of this species : The first is from two to four inches in height, bushy, irregularly branched, the branches straight, square, slightly tapered upwards, and formed of several parallel tubes : The second is a single thread-like tube which climbs up the stalks of other flexible corallines, giving off on all sides its long spreading trumpet-shaped cells, which are not unlike those of C. syringa, but are to be distinguished by their thicker and much more horny texture, and by being almost or altogether sessile. Small specimens of the first variety are very common on some sorts of crabs, but the larger specimens have their roots or base almost invariably immersed in the substance of a sponge, the Halichondria panicea or papillaris. The polypes are of a sulphur-yellow colour. They may often be seen at the bottom of the cells, contracted into a small shapeless mass ; the cell remaining unaltered and as open as in a dried state. The little tenant is very shy of extruding itself, and will remain for days in its contracted condition. When about to develope, the body is gradually lengthened, becoming at the same time narrower, so as to leave a vacant space between it and the walls of the cell ; and after a variable interval, the tentacula are as carefully extruded, and slowly spread out to their full expanse. These are from eight to twelve in number, supported on a sort of neck, and, like the tentacula of other Hydroida, are filiform, roughish, and rather short. When alarmed, the animal retreats quickly,* contracting itself in every dimension, and reducing the tentacula to almost undistinguishable knobs. It is a true mem-

* "It is the most active polype of its tribe I ever saw, starting up and down in its cell like one of the Ascidioids." *E. Forbes.* Professor Reid says that, on the contrary, the polypes "were sluggish."

Fig. 20.



ber of its order, being composed of a homogeneous somewhat granular jelly, very irritable and contractile, variable in shape, and in which no trace of vessels of any kind is to be discovered. Each polype is, moreover, connected behind with the central medulla of the common stalk, which is of the same colour and structure as the body of the polype itself. (Fig. 20.)

I have made the above description in order to correct an error of the first edition of this work. I have there said that the form of the cells, as well as the habit, of Camp. dumosa rendered its place in the genus doubtful; and I believed I had subsequently found reason to identify it with the *Cornularia rugosa* of Cavolini. The details now given shew that this conjecture was hasty and erroneous. The species, though not a well-marked Campanularia, is nevertheless too nearly allied to admit of its removal; and has, at all events, no affinity with *Cornularia*, which appears to be an aberrant genus of Asteroid polypes.

Is then the Cornularia rugosa, it may be asked, a native of our seas? Mr. J. E. Gray has referred to it a zoophyte, specimens of which he received from Miss Attersoll, who found them on the shore at Weymouth, parasitical on Tubularia indivisa (Annals of Nat. History, vol. i. p. 238). I have been favoured with some specimens of this from my friend Mr. Gray, whose sagacity as a naturalist, as well as his uncommon knowledge of species, I appreciate very highly.

Their close resemblance with Campanularia dumosa is shewn by a comparison of the annexed figures : Fig. 21 representing the Campanularia, and Fig. 22 the Weymouth presumed Cornularia, both

Fig. 21.

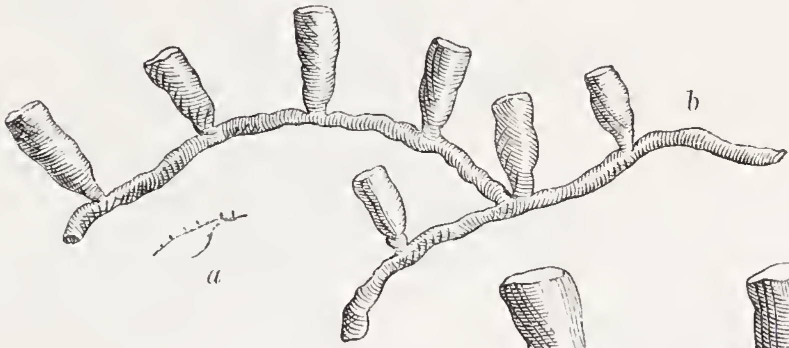
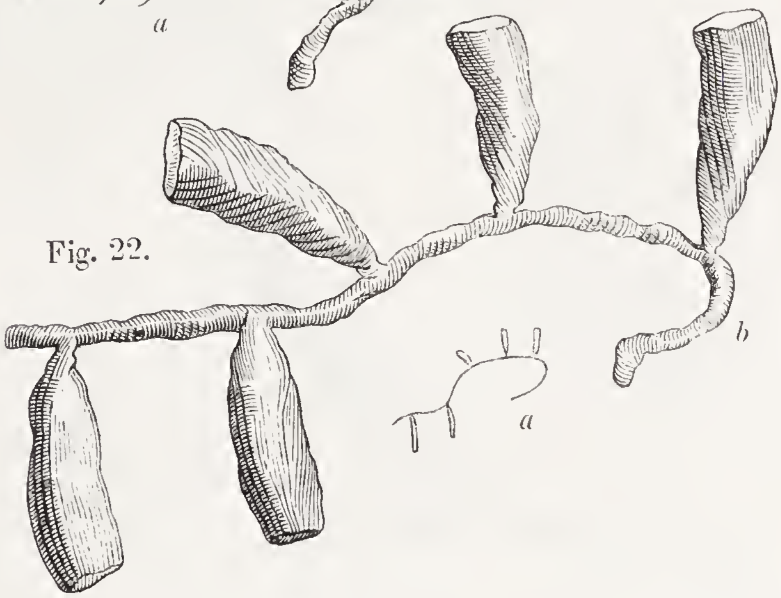
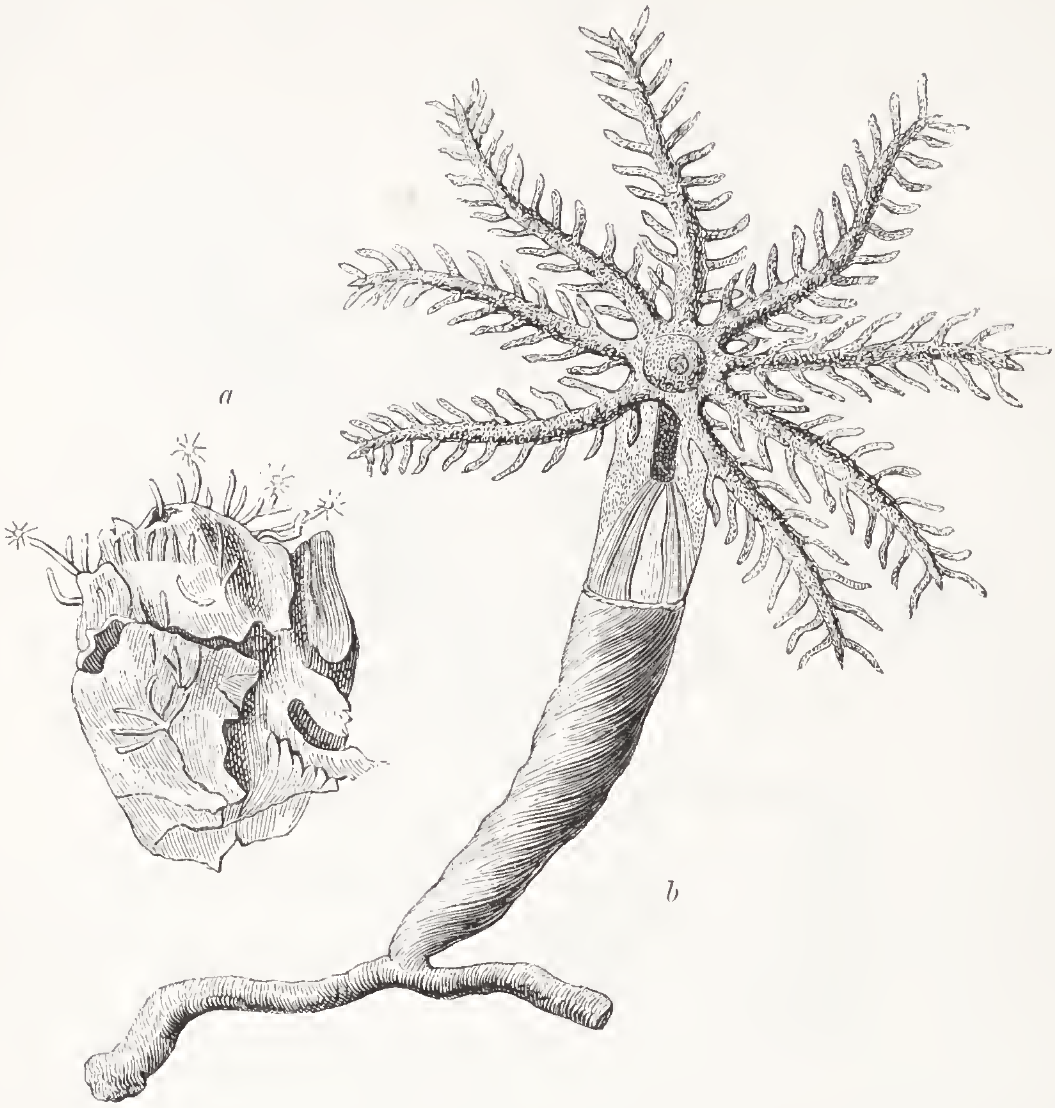


Fig. 22.



of them drawn from specimens which grew on Tubularia indivisa. They obviously differ in nothing but size,—a difference which may be the effect of some peculiarity in the habitat, and not greater than what we observe in some shells of the south when compared with those of the north of England. Until, therefore, the animal of the larger specimens has been examined, which Mr. Gray has had no opportunity of doing, it would, in my opinion, be premature to introduce the Cornularia into our catalogue. The more readily to enable the student to determine this point, I give a copy of Cavolini's figure of the species. At *a* of Fig. 23, on the next page, it is represented of its natural size ; and *b* is a magnified figure of a single individual.

Fig. 23.



This appears to be the proper place to notice two doubtful zoophytes which have been referred to the genus

Cymodocea,* Lamouroux.

Character. — " *Plant-like ; cells cylindrical, varying in length, filiform, alternate or opposite ; stem fistular, marked with rings below, plain above, and without interior division.*"

1. C. simplex, *stems simple, slightly undulated, twig-like ; cells long and filiform, alternate.* Dawson Turner.†

Cymodocea simplex, *Lamour.* Cor. Flex. 216, pl. 7, fig. 2. *Blainv.* Actinolog. 487. pl. 81, fig. 4.

* The name of one of the sea-nymphs into which the ships of Æneas were changed by Cybele.

† D. Turner, Esq. of Yarmouth, F.L.S.—very eminent for his knowledge of cryptogamic botany, and for his skill in antiquities. He is the author of a beautiful work on the Fuci. The genus *Dawsonia* of Robert Brown is a just tribute to his merit.

Hab. The sea near Yarmouth, and in Ireland, *Turner.*

Height nearly three inches : colour a yellow-fawn.

2. C. COMATA, *stems straight, cylindrical, almost simple; branchlets capillary, whorled, numerous, flexuous, jointed and celliferous.* Dr. Leach. *

Cymodocea comata, *Lamour.* Exposit. Method. 15, pl. 67, fig. 12, 13. *Flem.* Brit. Anim. 551.

Hab. Coast of Devonshire, *Leach.*

Height about one decimetre : colour yellowish. At each joint of the branchlets there is a short cell ringed at its base, and almost invisible to the naked eye.

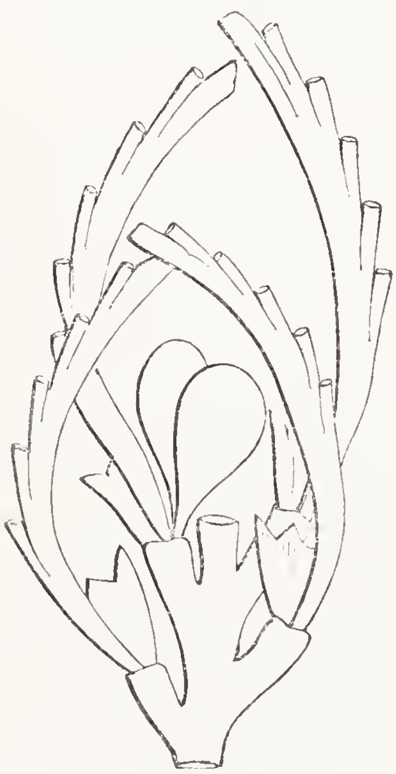
I have seen no authentic specimen of either species, the above descriptions being translated from the works of Lamouroux. He says that Cymodocea has the closest relations with Tubularia; from which, however, it differs in the position of the polype-cells, which are placed, not at the top of the branches, but upon these branches or upon their divisions. From this circumstance Lamouroux classes the genus amongst the Sertulariadæ, to which alliance the absence of ovarian vesicles seems opposed; nor can we hope to locate the genus with any certainty until the polypes have been discovered. The very existence of the genus has in fact been questioned. Mr. J. E. Gray, a high authority in matters of this kind, says, "the Cymodoceæ appear to be only Sertulariæ which have lost their cells" (Synop. of Brit. Mus. p. 75); and Blainville makes the same assertion in reference to the above species. Milne-Edwards also adopts this view (Lam. Anim. s. Vert. 2de édit. ii. 157). Mr. Couch is satisfied that *Cymodocea simplex* is founded on injured specimens of *Laomedea gelatinosa* (Zooph. Cornw. 24). Dr. Fleming is of opinion that *C. simplex* has been established from an individual of *Campanularia dichotoma* in a depauperated state (Brit. Anim. 548); while again Mr. Hogg informs me that he is almost satisfied that this Cymodocea is *Plumularia pinnata* with its pinnæ rubbed off by the waves or tide on the beach; and the specimens he has sent me, in confirmation of this supposition, are certainly very exact to Lamouroux's figure, *nat. size,*—for it must be observed that his

* William Elford Leach—a naturalist of most indomitable enthusiasm and very extraordinary acquirements. He died in Italy in 1836, of cholera. "We may say, with respect to the extent and effect of his zoological labours,—Nihil non tetigit, et omnia quæ tetigit ornavit."—*Kirby.*

magnified figure represents the polypidom as unjointed or continuous, whereas it is regularly jointed both in the Campanularia and Plumularia. But I make this remark, not to invalidate the opinions either of Dr. Fleming or Mr. Hogg, for that of the former I am disposed to adopt; but it gives me an opportunity of warning the student against an implicit reliance on the figures of Lamouroux, which we are assured by Blainville, who has compared them with the specimens from which they were made, are in many instances very erroneous.

Since the preceding sheet was printed, I have received from my friend, the Rev. D. Landsborough, a specimen of PLUMULARIA MYRIOPHYLLUM with ovaries. These are very peculiar, and unlike any I have observed in any other Sertularian zoophyte. In the ovigerous pinnules there arises from the base of the polype-cell, and on its outer side, a long gracefully curved process; and as all the processes curve round in one direction, they give the pinnule a secund character and habit very different from that of the barren shoots. The processes are alternate, hollow, coarsely denticulated on the external edge; and at their base, opposite the polype-cell, the ovaries are situated. These are didymous or in pairs, sessile, smooth, resembling a mussel-shell in shape, and easily detached. They differ from the horny vesicles of the Sertularinæ in texture and in shape, and may best be described as naked ovaries. The spinous process which protects them appears to be formed by a prolongation of the spine that supports the barren polype-cell. (Fig. 24.)

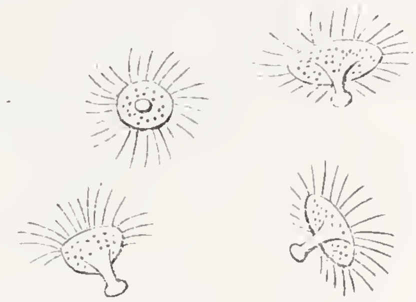
Fig. 24.



In a very ingenious essay on the morphology of the reproductive system of the Sertularian zoophyte, Professor Edw. Forbes has remarked that a dismemberment of the genera Sertularia and Plumularia will follow from his deductions relative to the composition of the ovarian vesicle. (Ann. and Mag. N. Hist. xiv. p. 390.) The latter genus is eminently artificial. 1. Plumularia falcata has a peculiar habit and a simple vesicle. 2. Plumularia cristata, and pennatula, agree in their dense horny structure and podded vesicles; and to them Pl. myriophyllum must be united, for its spinous processes are really the crested bands of the vesicles of the other species in a free or detached form. 3. Plumularia pinnata, setacea, and Catharina seem to be more nearly related to the Campanulariadæ, of which family their embryology may yet prove them to be members; and, notwithstanding its robust habit, Pl. frutescens may be equally referable to this category.

The embryo, however, of so few species of Sertularians has been yet seen, that general deductions should be hesitatingly received until a wider series of facts has been recorded. To contribute to this desirable end, I gladly avail myself of Mr. Peach's permission to publish his observations on Laomedea dichotoma and Campanularia volubilis. On the 19th of February, 1842, Mr. Peach placed a specimen of this Laomedea in a large glass filled with sea-water. On the 22nd the water appeared muddy, and this appearance was occasioned by myriads of moving embryos. "I took," says Mr. Peach, "a small quantity of the water, and placed it under the microscope, when thousands of the objects figured (Fig. 25) were sporting about in all directions, moving at a rapid rate by the ciliary appendages on their rim. All at once they would withdraw their cilia and the handle-like appendage on the back, and become a mere speck; and after resting a short time, they would again throw out their cilia and appendage, and round they went waltzing with each other. It was perfectly astonishing, in this crowded assembly, to find that they very seldom came into collision, and if so, how soon matters were again accommodated. They continued active up to the 2nd of March, when I lost them as if by magic. I fancied they might be the young of worms, therefore I took the specimen of Laomedea, washed it, took fresh sea-water and filtered it through three or four folds of fine linen, and placed the specimen in this: the next morning I had a still more innumerable host of these delightful things. They are represented in various positions, and when in the water they reminded me of thousands of parachutes thrown from a balloon, descending in various states of expansion."

Fig. 25.

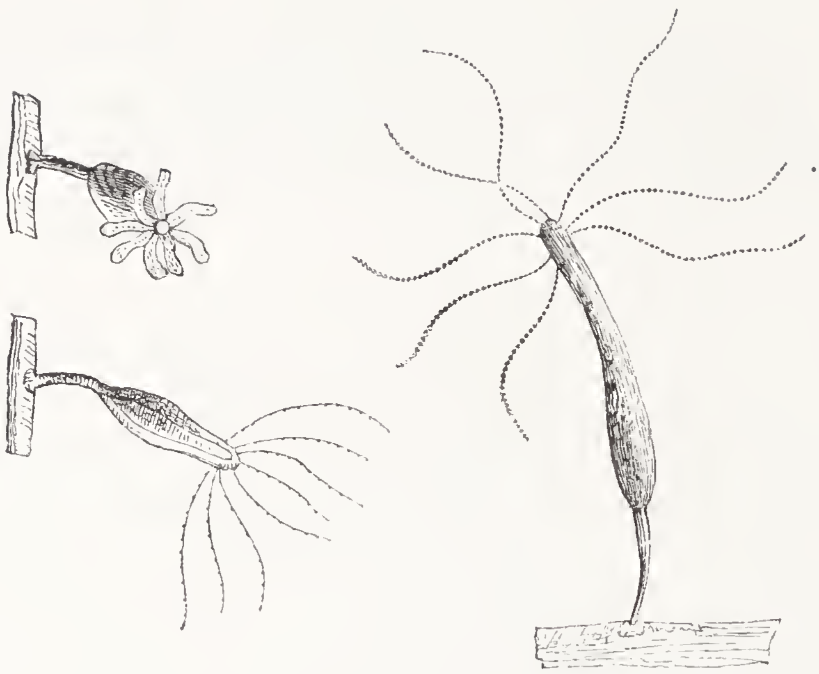


"On the 2nd of March, 1842, my *Campanularia* which I got on the 19th ult. also sent forth gemmules of the shape of fig. 26. I compared them to wire roasting-jacks, which have lions' heads made of lead to hold the wires together: these jacks are suspended by a string. They had no cilia, and moved by jerks, closing and opening; they had a film-like appendage attached to the ribs: in fact, the others appear film-like, but spotted. —I took the same precaution with these as the others, filtering the water, &c. &c. These lived only five days."

Fig. 26.

III. HYDRINA.

Fig. 27.



FAMILY—HYDRAIDÆ.

Genus HYDRA, *Lin.* Syst. 1320. *Pall.* Elench. 25. *Ellis* and *Soland.* Zooph. 8. *Lam.* Anim. s. Vert. ii. 57. *Blainv.* Actinolog. 494. *Flem.* Brit. Anim. 553.—Les POLYPES A BRAS, *Cuv.* Reg. Anim. iii. 294.—Family HYDRINA pars, *Ehrenberg* Corall. des roth. Meer. 67.—HYDROIDÆ, *Johnston* in Trans. Berw. Club, p. 107.—HYDRAIDÆ, *Gray* in Syn. Brit. Mus. 76.

Obs.—The true position of this family amongst animals is still undetermined. Van Beneden proposes to arrange it with the Medusæ. "Les Hydres sont des Méduses d'eau douce, et non Sertulaires. Leur véritable nature nous semble avoir été mal appréciée jusqu'ici." Mém. sur les Bryozaires, p. 7.

15. HYDRA,* Linnæus.

CHARACTER.—*Polypes locomotive, single, naked, gelatinous,*

* Ὕδρα—properly "a water-serpent," but the name has been appropriated to the monster of Lake Lerna, fabled to have fifty or one hundred heads, of which no sooner was one of them cut off, than two sprouted out in its place. From this property Linnæus was obviously led to apply the name to the animalcules in question.

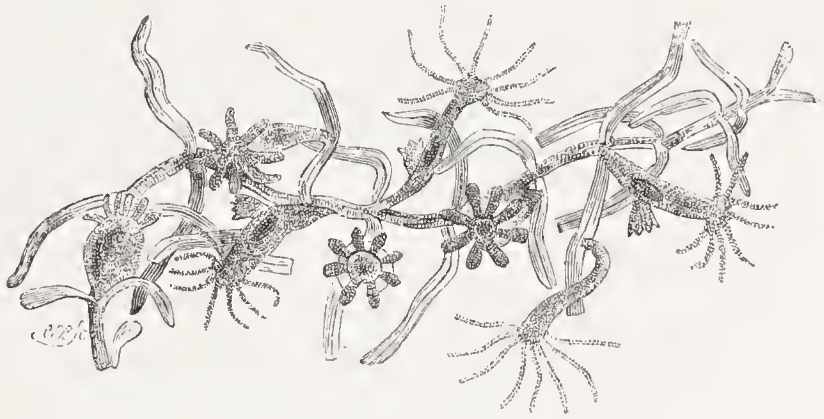
"To dire Lernæan *Hydra* what art thou?
Her wounds were fruitful; from each sever'd head
Each of her hundred necks two fiercer bred."

Sandy's Ovid.

sub-cylindrical, but very contractile and mutable in form, the mouth encircled with a single series of granulous filiform tentacula.

1. H. VIRIDIS, *grass-green; body cylindrical or insensibly narrowed downwards; tentacula* 6-10, *shorter than the body.*

Fig. 28.



Polypes verds, *Trembley* Mem. 22, pl. 1, fig. 1; pl. 3, fig. 1-10.—Fresh-water Polypus, *Trembley* in Phil. Trans. Abridg. viii. 623. *Folkes* in Ibid. 676, pl. 17, and pl. 18, fig. 1-3.—Hydra viridis, *Lin.* Faun. Suec. 367, No. 1283. *Lin.* Syst. 1320. *Mull.* Verm. I. ii. 13. Zool. Dan. prod. 230, No. 2783. Encyclop. Méthod. Vers, pl. 66, fig. 1-8. *Berk.* Syn. i. 221. *Ure*'s Rutherg. 232. *Turt.* Gmel. iv. 691. *Turt.* Br. Faun. 218. *Lam.* Anim. s. Vert. ii. 60. *Stew.* Elem. ii. 452, pl. 12, fig. 4, 5. *Rees*' Cyclop. Vermes, pl. 5, fig. 1. *Blumenbach's* Man. 275, pl. 1, fig. 10. *Bosc* Vers, ii. 274. *Stark* Elem. ii. 443. *Woodward* in Mag. Nat. Hist. iii. 349, fig. 89. *Roget* Bridgew. Treat. i. 162, fig. 59, and 176-8, fig. 73-76. *Adams* on the Microscope, 399, pl. 21, fig. 5. *Carus* Comp. Anat. tab. 1, fig. 1. *Ehrenb.* Corall. des roth. Meer. 67. *Landsborough* in Scot. Christ. Herald, n. s. i. 726. *Thompson* in Ann. and Mag. N. Hist. vii. 481.—H. viridissima, *Pall.* Elench. 31.—Third sort of Polype, *Baker*, Polyp. 19, c. fig.—De Groene Polyp met veale armen, *Rosel* Hist. der Insect. iii. tab. 88, 89.—Le Polype vert, *Cuv.* Reg. Anim. iii. 295.—L'Hydre verte, *Blainv.* Actinol. 494, pl. 85, fig. 1.

Hab. Ponds and still waters, common.

The polypes of this species differ from the following, "not only in colour, but likewise in their arms, which were much shorter in proportion to their bodies, capable of but little extension, and narrower at the root than the extremity, which is contrary to the other species. Their arms were so short, they could not clasp round a very small and slender worm, but seemed only to pinch it fast, till they could master and devour it, which they did with as much greediness as any. I imagined these polypes owed their green

colour to some particular food, such as weeds, &c. and that they would lose it upon being kept to worms; but I find myself mistaken, for they retain their greenness after some months as well as ever, and are now grown of a moderate size, extending sometimes three quarters of an inch; their arms are also lengthened very much to what they were, and are of a lighter green than the body, their number eight, nine, or ten. The tail is very little slenderer than the body, but more spread at the end than the tails of other kinds." *Baker.*

Pallas says that the offspring are produced from every part of the body; while Blainville thinks he has remarked that they shoot always from the same place, "au point de jonction de la partie creuse et de celle qui ne l'est pas." Blainville is candid enough, however, to inform us that Professor Van der Höven had made some observations adverse to his opinion;* and our own are certainly in accordance with those of Pallas and of the Professor of Leyden.

Trembley is careful to tell us that he discovered this species in June, 1740; nor can we smile at the particularity of the record when we remember that the discovery is the foundation of his immortal fame.† It was first observed in England in the spring of 1743 by a Mr. Du Cane of Essex. It appears to be a hardy animal. I have kept it for more than twelve months in a small vial of water unchanged during the whole of that time, and it remained lively, and bred freely; feeding on the minute Entomostraca confined with it, and which, propagating much more abundantly, furnished a good supply of what was evidently a favourite food.

2. H. VULGARIS, *orange-brown or yellowish; body cylindrical; tentacula* 7-12, *as long or longer than the body.*

PLATE XXIX. FIG. 2.

Polypes de la seconde espèce, *Tremb.* Mem. pl. 1, fig. 2, 5; pl. 2, fig. 2; pl. 6, fig. 2 and 8; pl. 8, fig. 1-7; pl. 10, fig. 1-7; pl. 11, 12, 13. figs. omn. partly copied in *Adams* Micros. 399, pl. 21, fig. 6. *Rosel* Hist. der Insect. iii. Polyp. tab. 78 to 83. (In these plates the species is represented in many states, simple and proliferous, and also in the act of seizing the little worms on which it preys.) *Ehrenb.* Corall. des roth. Meer. 68.—Hydra vulgaris, *Pall.* Elench. 30. *Ellis* in Phil.

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* Bulletin des Sc. Nat. xvi. 337.

† "Trembley (Abraham), de Génève, né en 1710, mort en 1784; *immortel* par le découverte de la reproduction du polype." Cuvier, Reg. Anim. iii. 422.—Blumenbach also informs us that his observations on this polype first led him to his ingenious investigations on the *Nisus formativus*.

Trans. lvii. 430. *Ellis* and *Soland.* Zooph. 9. Encyclop. Method. Vers, pl. 67. *Rees'* Cyclop. Vermes, pl. 5, fig. 2.—H. grisea, *Lin.* Syst. 1320. *Mull.* Verm. I. ii. 14. *Couch* Faun. Corn. iii. 136. *Ure*'s Rutherg. 233. *Berk.* Syn. i. 222. *Blumenb.* Man. 295. *Lam.* Anim. s. Vert. ii. 60. *Templeton* in Mag. Nat. Hist. ix. 418.—H. brunnea, *Templeton*, loc. cit. 417, fig. 56.—First sort of Polype, *Baker* Polyp. 17, c. fig.— Polypes d'eau douce, *M. Edwards* Elem. de Zool. 10, fig. 1.

Hab. Weedy ponds and slowly running waters.

This does not exceed the H. viridis in size, which it resembles also in its habits and form. It is always of an orange, brown, or red colour, the intensity of the tint depending on the nature of the food, on the state of the creature's repletion, becoming even blood-red when fed upon the small crimson worms and larvæ which usually abound in its haunts.* The tentacula in all my specimens have never exceeded the length of the body, are usually seven or eight in number, and taper to the point insensibly. Every part of the body is generative of young, which may frequently be seen hanging from the parent at the same time in different stages of their growth.

3. H. ATTENUATA, *light oil-green, the body attenuated below, with pale tentacula longer than itself.* G. J.

PLATE XXIX. FIG. 1.

Hab. Ponds. Yetholm Lough, Roxburghshire.

Rosel Ins. iii. Polyp. tab. 76 and 77.—Hydra attenuata, *Pall.* Elench. 32. *Ehrenb.* Corall. des roth. Meer. 68.—H. pallens, *Turt.* Gmel. iv. 692. *Lam.* An. s. Vert. 2de édit. ii. 71.

This, which is represented very exactly in the plates of *Rosel's* beautiful work quoted above, is a larger animal than H. vulgaris, and comparatively rare, less sensible to external impressions, and of

* "I have found a *bright-red* Hydra rather abundant on Putney Heath, near London. It does not much differ, except in colour, from the green one." *J. E. Gray in lit. May* 6, 1833.—See Trembley's Mem. p. 47, and 128.—M. Laurent has succeeded in colouring Hydræ blue, red, and white, by means of indigo, carmine, and chalk, "sans pénétration réelle dans le tissu. Les bourgeons de ces Hydres ont acquis la même couleur que leurs mères, tandis que la couleur des œufs persiste comme dans l'état naturel, et ne subit aucune modification, quoique l'Hydre mère ait été nourrie lavant et pendant ce mode de reproduction avec des substances colorantes, et que son corps et ses bras soient très vivement colorés." M. Laurent has also engrafted these variously coloured Hydræ on each other.—Comptes Rendus des Séances de l'Acad. des Sciences, Juin 21, 1841.

a more gracile form. Its colour is a dilute olive-green with paler tentacula, which are considerably longer than the body, and hang like silken threads in the water, waving to and fro without assuming that regular circular disposition which they commonly do in the H. viridis. I have not observed more than one young at a time, which pullulated from near the middle of the body; and after this has attained a certain growth, the polype has the appearance of being dichotomously divided.

Dr. Fleming's *Hydra vulgaris*, Brit. Anim. 553, embraces this and the preceding, as well as the following species, which are considered the mere variations of one protean original :—

> "Facies non omnibus una,
> Nec diversa tamen :"

but the conviction of their permanent distinctness has been forced upon me by a long continuous observation of individuals in a state of confinement. Had, however, personal observation been wanting, the same conclusion would have been willingly adopted on the paramount authorities of Trembley and Baker, who had very carefully studied these creatures; and Pallas speaks very decidedly to the same purport: "Species Hydræ a Linnæo* pro varietatibus habitas, a Rœselio primum bene determinatas adoptavi, cum de trium priorum constantia, propria me experientia certissimum reddiderit." —*Elench.* 29.

4. H. OLIGACTIS, *brown or griseous; inferior half of the body suddenly attenuated; tentacula several times longer than the body.*

VIGNETTE, No. 27. PAGE 120.

Polypes à long bras, *Tremb.* Mem. pl. 1, fig. 3, 4, 6 ; pl. 2, fig. 1, 3, 4 ; pl. 3, fig. 11 ; pl. 5, fig. 1-4 ; pl. 6, fig. 3-7, 9, 10 ; pl. 8, fig. 8, 11 ; pl. 9. copied in *Adams* Micros. 399, pl. 21, fig. 7, 8 ; pl. 23, A. B ; pl. 24, A. B, fig. omnes. *Rosel* Hist. der Insect. Polyp. iii. pl. 84-87. *Cuv.* Reg. Anim. iii. 295.—Long-armed Fresh-water Polype, *Ellis* Corall. xvi. pl. 28, fig. C. (the tentacula shortened, for the conveniency of introducing them within the size of the plate).—Second sort of Polype, *Baker* Polyp. 18, c. fig.—Hydra oligactis, *Pall.* Elench. 29. *Ehrenb.* Corall. des roth. Meer. 68.—H. fusca, *Lin.* Syst. 1320. Encyclop. Method. Vers, pl. 69, fig. 1-9. *Rees'* Cyclop Vermes, pl. 5, fig. 3. *Ellis* and *Soland.* Zooph. 9. *Blumenb.* Man. 275. *Lam.* Anim. s. Vert. ii. 60.—Hydra verrucosa, *Templeton* in Mag. Nat. Hist. ix. 418, fig. 57. *Allman* in Ann. Nat. Hist. xiii. 328.

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* In the 10th edit. of Syst. Nat. p. 816, under the name of *Hydra Polypus*.

Hab. Still waters in England, rare. In a pond at Hackney, *Mr. John Ellicot.** "In the pond at Cranmore (near Belfast), Sept. 1812," *J. Templeton.*

"The tails of these are long, slender, and transparent, and, when placed before the microscope, a long straight gut may plainly be distinguished passing from the body-part or stomach to an opening at the end thereof. These are rather lighter-coloured than the former (H. vulgaris), and have seldom more than six or eight arms, but those capable of great extension."—*Baker.*

Baker reckoned that his English exemplars were of a sort different from those he had received from M. Trembley, but the only apparent difference lies in the greater shortness of the tentacula of the former; and this is a character liable to considerable variation, and insufficient of itself for specific distinction. The species has been beautifully illustrated in Trembley's "Mémoires" by the pencil and graver of the celebrated Lyonnet; for it is an interesting fact, that all the figures, and most of the plates, which adorn the admirable book just mentioned, were drawn and etched by the author of the "Traité anatomique de la chenille du saule,"† and are, indeed, among the very earliest specimens of his extraordinary attainments in these arts.

In his Plates 86 and 87 Rosel delineates, with his usual elegance, a very remarkable proliferous variety—a great number of young ones pullulating from the very base of the principal polype, and challenging a comparison with some proliferous varieties of the onion cultivated by curious gardeners.

It may be worth while to call attention to the remarkable resemblance of the Hydra fusca to the *Cucullanus cirratus* of Müller, Zool. Dan. tab. 38, fig. 1-7, which is an intestinal worm !

Observations.

Leeuwenhoek‡ discovered the Hydra in 1703, and the uncommon way its young are produced ; and an anonymous correspondent of

* Elected F.R.S. Oct. 26, 1738 ; and the author of several papers on subjects in Natural Philosophy, published in the Phil. Trans. between the years 1745 and 1750. He was a watchmaker, and died in 1772.

† "Ouvrage qui est à la fois le chef-d'œuvre de l'anatomie et celui de la gravure." *Cuvier.*—See also *Cuv.* Hist. des Sc. Nat. iii. 256.

‡ "Antonius v. Leeuwenhoek, civis Delphensis, peritus vitrorum politor, curiosus, et ad paradoxas opiniones pronus." Haller, Bib. Bot. i. 583. He was born 1632 ; elected F.R.S. January 1680 ; and died in 1723.

the Royal Society made the same discovery in England about the same time; but it excited no particular notice until Trembley made known its wonderful properties, about the year 1744. These were so contrary to all former experience, and so repugnant to every established notion of animal life, that the scientific world were amazed; and while the more cautious among naturalists set themselves to verify what it was difficult to believe, there were many who looked upon the alleged facts as impossible fancies. The discoveries of Trembley were, however, speedily confirmed; and we are now so familiar with the outlines of the history of the fresh-water polype, and its marvellous reproductive powers, that we can scarcely appreciate the vividness of the sensation felt when it was all novel and strange: when the leading men of our learned societies were daily experimenting on these poor worms, and transmitting them to one another from distant countries, by careful posts, and as most precious gifts; and when even ambassadors interested themselves in sending early intelligence of the engrossing theme to their respective courts.*

The Hydræ are found in fresh waters only. They prefer slowly running or almost still water, and fasten to the leaves and stalks of submerged plants by their base, which seems to act as a sucker. The body is exceedingly contractile, and hence liable to many changes of form: when contracted, it is like a tubercle, a minute top or button; and when extended, it becomes a narrow cylinder, being ten or twelve times longer at one time than at another, the tentacula suffering changes in their length and diameter equal to those of the body. "It can lengthen out or shorten its arms, without extending or contracting its body; and can do the same by the body, without altering the length of its arms: both, however, are usually moved together, at the same time and in the same direction." On the point opposite the base, and in the centre of the tentacula, we observe an aperture or mouth which leads into a wider cavity, excavated as it were in the midst of the body,† and

* Hence the inquiry became an object of ridicule with our popular writers. See Goldsmith's Citizen of the World, letter 89. What saith posterity? "Trembley acquit une réputation universelle par sa découverte extraordinaire, qui changeait, pour ainsi dire, toutes les idées qu'on avait eues sur la physiologie et l'anatomie animales." Who is this partial judge? His decisions may have been favourable; but who shall accuse Georges Cuvier of injustice? See his Hist. des Sciences Nat. iii. p. 256.

† Pallas denies this. "Ab alimento recepto *cavatæ*, inquam, haud enim Hydræ

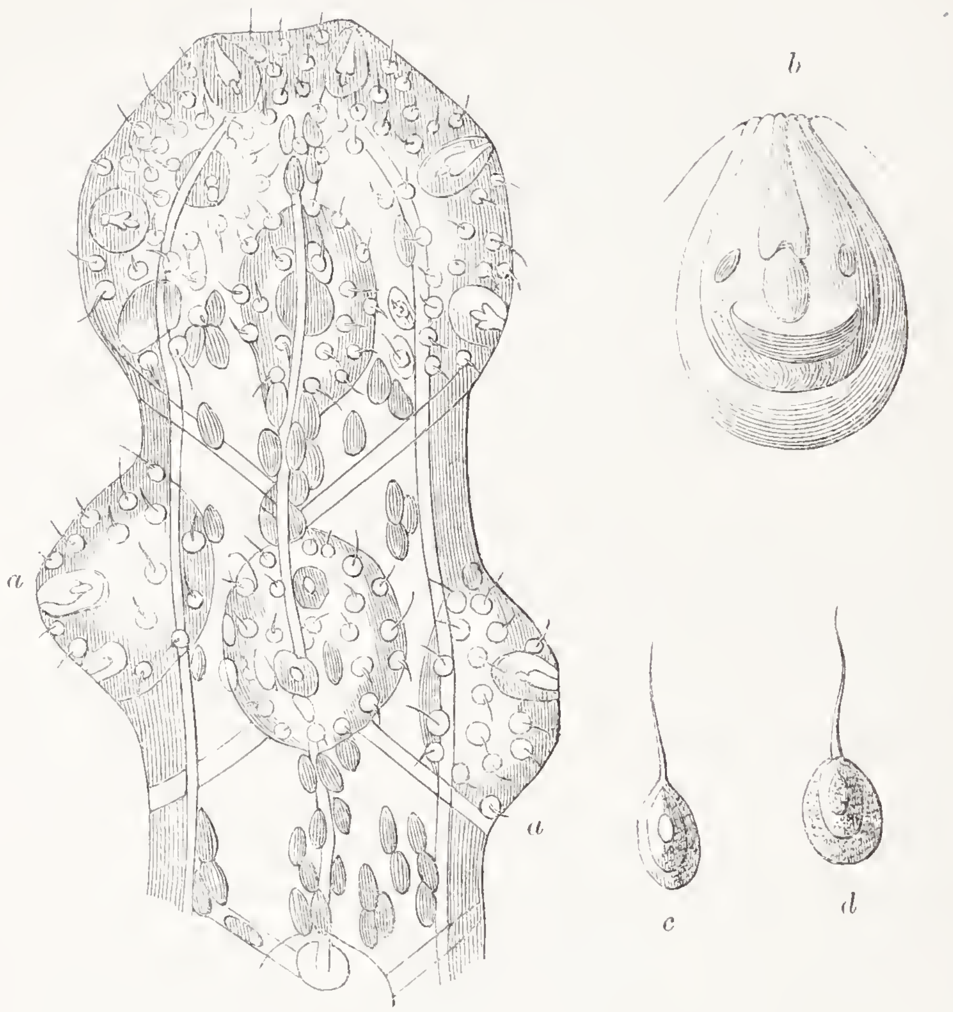
from which a narrow canal is continued down to the sucker. When contracted, and also when fully extended, the surface appears smooth and even, but "in its middle degree of extension," the sides seem to be minutely crenulated—an effect probably of a wrinkling of the skin, although from this appearance Baker has concluded that the Hydra is annulose, or made up of a number of rings capable of being folded together or evolved; and hence, in some measure, its extraordinary ability of extending and contracting its parts.* That this view of the Hydra's structure is erroneous, Trembley has proved;† and the explanation it afforded of the animal's contractility was obviously unsatisfactory, for it was never pretended that such an anatomy could be detected in the tentacula, which, however, are equally or more contractile. These organs encircle the mouth, and radiate in a star-like fashion; but they seem to originate a little under the lip, for the mouth is often protruded like a kind of small snout: they are cylindrical, linear or very slightly tapered, hollow and roughened, at short and regular intervals, with whorls of tubercles which, under the microscope, form a very beautiful and interesting object. According to Corda, each tentaculum forms a slender membranaceous tube, filled with an albuminous nearly fluid substance, intermixed with some oleaginous particles; and at certain definite places this substance swells out into tubercles or denser wart-like *nodules*, which are arranged in a spiral line. (Fig. 29, *a*.) Every *nodule* is furnished with several spinigerous vesicles, used as organs of touch, and with a very singularly constructed organ for catching the prey. The organ of touch consists of a fine sac enclosing another with thicker parietes, and within this there is a small cavity. From the point where the two sacs coalesce above, there projects a long *cilium* or capillary spine, which is non-retractile, and apparently immoveable. (*c*, *d*.) Surrounded by these cilia, and in the centre of the *nodule*, is placed the captor organ, called the *hasta*.

corpus naturaliter intestini instar cavum crediderim. Totum solidum et medullare, pro admoto alimento, ceræ instar, digitum admittentis, cavari concipio parenchyma et alimentis insinuatis sese circumfundere. Qui alias per longitudinem dissecta Hydra, illico qualibet portione deglutire, et cavo clauso alimenta condere posset? quod tamen observare rarum non est." Elench. Zooph. 27, 28.—For a view of the Hydra's stomach, see Tremb. Mem. pl. 4, fig. 7, copied by Roget in his Bridgew. Treat. ii. 74, fig. 241.

* "The outward coat is white like the arms, and made up of minute *annuli* or ringlets, that double in the midst, and can, occasionally, be folded close together, in the manner of a paper lanthorn."—Hist. of the Polype, 25.

† Mem. 27.

Fig. 29.



This consists of an obovate transparent sac, immersed in the nodule, with a small aperture even with the surface. At the bottom of the sac, and within it, there is a saucer-like vesicle, on whose upper depressed surface is seated a solid ovate corpuscle, that gives origin to, or terminates in, a calcareous sharp *sagitta* or arrow, that can be pushed out at pleasure, or withdrawn till its point is brought within the sac. (*b.*) When the Hydra wishes to seize an animal, the *sagittæ* are protruded, by which means the surface of the tentacula are roughened, and the prey more easily retained ; and Corda believes that a poison is at the same time injected—a conjecture offered to explain the remarkable fact of the almost instant death of the prey.

The *nodules* of the tentacula are connected together by means of four muscular fibres or bands, which run up forming lozenge-shaped spaces by their intersections. These are the *extensor* muscles of the tentaculum. (*a.*) They are again joined together by transverse fibres, which Corda believes to be *adductor* muscles, and to have also the power of shortening the tentacula. But it may be doubted whether this muscular apparatus is of itself sufficient to effect the wonderful

extensibility of these organs,—from a line to one, or, as in H. fusca, to upwards of eight inches ; and to produce this degree of elongation, it seems necessary to have superadded the propulsive agency of a fluid. Water flows, let us say by suction, into the stomach through the oral aperture, whence it is forced by the vis à tergo, or drawn by capillary attraction into the canals of the tentacula, and its current outwards is sufficient to push before it the soft yielding material of which they are composed, until at last the resistance of the living parts suffices to arrest the tiny flood, or the tube has become too fine in its bore for the admission of water attenuated to its smallest possible stream,—how inconceivably slender may indeed be imagined, but there is no thread fine enough to equal it, seeing that the tentacula of Hydra fusca in tension can be compared to nothing grosser than the scarce visible filament of the gossamer's web.

The Hydra, though usually found attached, can nevertheless move from place to place, which it does either by gliding with imperceptible slowness on the base, or by stretching out the body and tentacula to the utmost, fixing the latter, and then contracting the body towards the point of fixture, loosening at the same time its hold with the base ; and by reversing these actions it can retrograde. Its ordinary position seems to be pendant, or nearly horizontal, hanging from some floating weed or leaf, or stretching from its sides. In a glass of water the creature will crawl up the sides of the vessel to the surface, and hang from it, sometimes with the base, and sometimes with the tentacula downwards ; and again it will lay itself along horizontally.* Its locomotion is always very slow,

* "The position in which they appear to take most delight is that of remaining suspended from the surface of the water by means of the foot alone ; and this they effect in the following manner. When the flat surface of the foot is exposed for a short time to the air, above the surface of the water, it becomes dry, and in this state exerts a repulsive action on the liquid, so that when dragged below the level of the surface by the weight of the body, it still remains uncovered, and occupies the bottom of a cup-shaped hollow in the fluid, thereby receiving a degree of buoyancy sufficient to suspend it at the surface. The principle is the same as that by which a dry needle is supported on water, in the boat-like hollow which is formed by the cohesive force of the liquid, if care be taken to lay the needle down very gently on the surface. If, while the Hydra is floating in this manner, suspended by the extremity of the foot, a drop of water be made to fall upon that part, so as to wet it, this hydrostatic power will be destroyed, and the animal will immediately sink to the bottom." Roget, Bridgew. Treat. i. 179.—This passage is nearly a literal translation from Trembley's Hist. des Polypes, pp. 37-8.

and the disposition of the zoophyte is evidently sedentary; but the contractions and mutations of the body itself are sufficiently vivacious, while in seizing and mastering its prey it is surprisingly nimble, seizing a worm, to use the comparison of Baker, "with as much eagerness as a cat catches a mouse." It is dull, and does not expand freely in the dark, but enjoys light; and hence undoubtedly the reason why we generally find the Hydra near the surface and in shallow water.

The Hydræ are very voracious, feeding only on living animals;* but, when necessary, they can sustain a fast of many weeks, without other loss than what a paler colour may indicate. Small larvæ, worms, and entomostracous insects seem to be the favourite food; and to entrap these they expand the tentacula to the utmost, and spread them in every direction, moving them gently in the water to increase their chances; and when a worm touches any part of them, it is immediately seized, carried to the mouth by these flexible and contractile organs, and forced into the stomach. "'Tis a fine entertainment," says Baker, "to behold the dexterity of a polype in the mastering its prey, and observe with what art it evades and overcomes the superior strength or agility thereof. Many times, by way of experiment, I have put a large worm to the very extremity of a single arm, which has instantly fastened on it with its little invisible claspers. Then it has afforded me inexpressible pleasure to see the polype poising and balancing the worm with no less seeming caution and judgment than a skilful angler shows when he perceives a heavy fish at the end of a single hair-line, and fears it should break away. Contracting the arm that holds it, by very slow degrees, he brings it within the reach of his other arms, which eagerly clasping round it, and the danger of losing it being over, all the former caution and gentleness is laid aside, and it is pulled to the polype's mouth with a surprising violence." † Sometimes it happens that two polypes will seize upon the same worm, when a struggle for the prey ensues, in which the strongest gains of course the victory; or each polype begins quietly to swallow his portion, and continues to gulp down his half, until the mouths of the pair near, and come at length into actual contact. The rest which now ensues appears to prove that they are sensible

* In confinement, however, Trembley found that they might be fed on minced fish, beef, mutton, or veal.—Mem. 104.

† Hist. of the Polype, 65. Also Roget's Bridgew. Treat. ii. 76.

of their untoward position, from which they are frequently liberated by the opportune break of the worm, when each obtains his share ; but should the prey prove too tough, woe to the unready! The more resolute dilates the mouth to the requisite extent, and deliberately swallows his opponent, sometimes partially, so as, however, to compel the discharge of the bait, while at other times the entire polype is engulphed! But a polype is no fitting food to a polype, and his capacity of endurance saves him from this living tomb; for after a time, when the worm is sucked out of him, the sufferer is disgorged with no other loss than his dinner.* This fact is the more remarkable when it is contrasted with the fate which awaits the worms on which they feed. No sooner are these laid hold upon than they evince every symptom of painful suffering ; but *their violent contortions are momentary, and a certain death suddenly follows their capture.* How this effect is produced is still matter of conjecture. Worms, in ordinary circumstances, are most tenacious of life, even under severe wounds ; and hence one is inclined to suppose that there must be something eminently poisonous in the Hydra's grasp. "I have sometimes," says Baker, "forced a worm from a polype the instant it has been bitten (at the expense of breaking off the polype's arms), and have always observed it to die very soon afterwards, without one single instance of recovery."† To the Entomostraca, however, its touch is not equally fatal ; for I have repeatedly seen Cyprides and Daphniæ, entangled in the tentacula and arrested for some considerable time, escape even from the very lips of the mouth, and swim about afterwards unharmed—their shell evidently protecting them from the poisonous excretion. The grosser parts of the food, after some hours' di-

* Trembley, Mem. 112.

† Hist. of the Polype, 33—comp. with 67-8. — "That insignificant and inactive insect called the fresh-water polypus, of all poisonous animals, seems to possess the most powerful and active venom. Small water-worms, which the polypus is only able to attack, are so tenacious of life, that they may be cut to pieces without their seeming to receive any material injury, or to suffer much pain from the incisions. But the poison of the polypus instantly extinguishes every principle of life and motion. What is singular, the mouth or lips of the polypus have no sooner touched this worm than it expires. No wound, however, is to be perceived in the dead animal. By experiments made with the best microscopes, it has been found that the polypus is neither provided with teeth, nor any other instrument that could pierce the skin." Smellie's Phil. of Nat. History, ii. 462.—The fact that fishes cannot be made to swallow Hydræ, seems to prove the presence of some irritating quality in the latter. See Trembley, Mem. 137.

gestion, are again ejected by the mouth; but, as already mentioned, the stomach is furnished with what, in one sense, may be called an intestine, to which, according to Trembley and Baker, there is an outlet in the centre of the base; and the latter asserts that he has "several times seen the dung of the polype in little round pellets discharged at this outlet or anus."*

But the Hydra is principally celebrated on account of its manner of propagation. It is, like zoophytes in general, monœcious; and every individual possesses the faculty of continuing and multiplying its race, principally, however, by the process of subdivision. During the summer season, a small tubercle rises on the surface, which lengthening and enlarging every hour, in a day or two develops in irregular succession, or in successive pairs,† a series of tentacula, and becomes, in all respects excepting size, similar to its parent. It remains attached for some time, and grows and feeds, and contracts and expands after the fashion of this parent, until it is at length thrown off by a sort of sloughing or exfoliation. These buds sprout, in the common species, from every part of the body inferior to the stomach, but not from the tentacula; and very often two, three, or four young may be seen depending at one time from the sides of the fruitful mother, in different stages of growth, each playing its part independent of the others:

> "—— where some are in the bud,
> Some green, and rip'ning some, while others fall."

They are evolved with rapidity in warm weather especially, one no sooner dropping off than another begins to germinate; "and what is most extraordinary, the young ones themselves often breed others, and those others sometimes push out a third or fourth generation before the first fall off from the original parent." Trembley found, in one experiment, that an individual of H. grisea produced forty-five young in two months. The average number per month in summer was twenty; but as each of these began to produce four

* Lib. s. cit. 27.—He adds: "Much the greater and grosser part of what the polype eats is most certainly thrown out again by the mouth, after lying a proper time to become digested in the stomach: and, for a good while, I imagined there was no other evacuation; but am now convinced that the finer part, in small quantity, is carried downwards through the tail, and passed off that way. I believe, however, there is also another purpose to which this passage serves, and that is, to convey a mucus or slimy matter to the end of the tail, for its more ready adhesion to sticks, stalks, or other bodies."

† Baker's Hist. 35.

or five days after its separation, the whole produce of a month was prodigious.*

"No sooner is a young one furnished with arms, than it seizes and devours worms with all possible eagerness ; nor is it an unusual thing to behold the young one and the old one struggling for, and gorging, different ends of the same worm together. Before the arms come out, and even some time afterwards, a communication continues between the bodies of the old and young, as appears beyond dispute by the swelling of either when the other is fed.† But a little before the young one separates, when its tail-end begins to look white, transparent, and slender, the passage between them, I believe, is closed. And when the young one comes away, there remains not the least mark where it had been protruded."—"After a young polype once gets all its arms, it alters indeed in size, but neither appears to shift its skin, nor undergo any of the changes most other insects do."‡

Instead of buds or little protuberances, the body sometimes pushes forth single tentacula scattered irregularly over it, and these tentacula can be metamorphosed into perfect polypes, the base swelling out to become the body, which again soon shoots out additional tentacula to the requisite number ! §

This is a mode of generation which the term viviparous does not correctly embrace, unless we give to that word a signification so extensive as to include all generations which are not oviparous : it is an example of equivocal, or what some foreign physiologists denominate, the generation by the individualisation of a tissue previously or already organised,||—and seems to be the usual way of propagation among the Hydræ during the summer months. But in autumn the Hydra generates internal oviform gemmules, which, extruded

* Mem. pour l'Hist. des Polypes, 174-5. Also Baker, lib. s. cit. 53-4.

† By some clever dissections, Trembley demonstrated the reality of this communication. Mem. 161-2.

‡ Baker, lib. s. cit. 50.

§ Baker ut cit. 110-11 ; 121-3.

|| "La génération n'est pas pour cela spontanée ; une *génération spontanée* doit être la production d'un être organisé de toutes pièces, lorsque des élémens inorganiques se rèuniront pour produire un animal, une plante. Cette génération est impossible, et n'a jamais lieu. Une *génération équivoque* est celle où des tissus organisés préalablement par un être déjà pourvu de vie, *s'individualisent*, c'est-à-dire se séparent de la masse commune et participent encore, après cette séparation, de l'état dynamique de la masse, c'est-à-dire de sa vie, mais, à son propre profit. C'est ainsi qu'un tissu produit un Entozoaire. C'est de la vie continuée."—Ch. Morren in Ann. des Sc. Nat. vi. p. 90.

from the body, lie during the winter in a quiescent state, and are stimulated to evolution not until the return of spring and its genial weather. Few observations have been made on these ova; so that their structure, their source, their manner of escape from the body, and their condition during winter, are scarcely known. Trembley describes them as little spherical excrescences, of a white or yellow colour, attached to the body by a very short pedicle. He never saw more than three on the same polype. After some time they became separate, and fell to the bottom of the glass of water in which the creatures were kept, where they came to nothing, excepting one only, which was presumed to have evolved into a polype; for although his experiment renders this conclusion probable, it was still rather an inference than an actual observation—so much so, that Trembley continued to entertain doubts of their nature. Jussieu, it seems, conceived that each little excrescence was a vesicle filled with minute ovules; and Ehrenberg's opinion differs from this merely in the mode of expression, for he calls the deciduous autumnal bud, (which, he says, has no tentacula, and is loaded with ova,) a female or hermaphrodite polype.

It appears that Ehrenberg and Dujardin have described and figured the ova of the Hydræ as being spinous, but M. Laurent has never found them to be so. According to this naturalist, when a Hydra has laid its ovules, it gradually lowers itself and covers them with the half of its body; which, spreading out and thinning proportionably, passes into the condition of a horny substance, that glues to plants and other substances the eggs disposed in a circular manner around the mother. She ends her course by dying in the midst of these ova. M. Laurent has procured eggs from the individuals of three successive generations; that is, from a mother, from her eldest progeny, and from her youngest, and from her grand-children; all of which died in the manner described after having laid their eggs.*

These are the modes in which the Hydra naturally multiplies its kind; but it can be increased, as already hinted, by artificial sections of the body, in the same manner that a perennial plant can be by slips and shoots. If the body is halved in any direction, each half in a short time grows up a perfect Hydra; if it is cut into four or eight, or even minced into forty pieces,† each continues alive, and

* L'Institut, no. 465, Nov. 1842, p. 416.

† "J'ai ouvert sur ma main un polype, je l'ai étendu, et j'ai coupé en tout sens la peau simple qu'il formoit, je l'ai réduit en petits morceaux, je l'ai en quelque manière

develops a new animal, which is itself capable of being multiplied in the same extraordinary manner. If the section is made lengthways, so as to divide the body into two or more slips connected merely by the tail, they are speedily resoldered, like some heroes of fairy tale, into one perfect whole ; or if the pieces are kept asunder, each will become a polype ; and thus we may have two or several polypes with only one tail between them ; but if the sections be made in the contrary direction—from the tail towards the tentacula—you produce a monster with two or more bodies and one head. If the tentacula—the organs by which they take their prey, and on which their existence might seem to depend—are cut away, they are reproduced, and the lopt-off parts remain not long without a new body. If only two or three tentacula are embraced in the section, the result is the same ; and a single tentaculum will serve for the evolution of a complete creature.* When a piece is cut out of the body, the wound speedily heals, and, as if excited by the stimulus of the knife, young polypes sprout from the wound more abundantly, and in preference to unscarred parts ; when a polype is introduced by the tail into another's body, the two unite and form one individual ; and when a head is lopt off, it may safely be ingrafted on the body of any other which may chance to want one. You may slit the animal up, and lay it out flat like a membrane, with impunity : nay, it may be turned inside out, so that the stomachal surface shall become the epidermous, and yet continue to live and enjoy itself.† And the creature even suffers very little by these

* haché. Ces petits morceaux de peau, tant ceux qui avoient des bras, que ceux qui n'en avoient point, sont devenus des polypes parfaits." Trembley, Mem. 248.—Romé de Lisle attempted to lessen the remarkableness and singularity of this fact by supposing that the Hydra was a colony of minute animalcules held together in a moveable polypidom, represented by the thin outer cuticle, and of course that this cutting and division only set free a number of independent entire beings. The hypothesis is a bold one, but has nothing in the way of observation to support it.—See Blainv. Actinol. p. 563.

* From the experiments of Trembley (Mem. 235), of a correspondent of Baker's, and of Baker himself, it would seem that a tentaculum cannot produce a new body unless a part of the head or body is removed with it (Hist. 193-4) ; but other experimentalists are said to have succeeded when this was done. For the particulars stated in the text, and others equally incredible, the reader may consult the works of Trembley and Baker, *passim*.

† Trembley had several by him " that have remained turned in this manner ; their inside is become their outside, and their outside their inside : they eat, they grow, and they multiply, as if they had never been turned."—Phil. Trans. Abridg. viii. 627 ; and his Mem. 253, &c.

apparently cruel operations,

——" scarce seems to feel, or know
His wound,"—

for before the lapse of many minutes, the upper half of a cross section will expand its tentacula and catch prey as usual; and the two portions of a longitudinal division will, after an hour or two, take food and retain it. " A polype, cut transversely in three parts, requires four or five days in summer, and longer in cold weather, for the middle piece to produce a head and tail, and the tail part to get a body and head; which they both do in pretty much the same time. The head part always appears a perfect polype sooner than the rest."—" And what is still more extraordinary, polypes produced in this manner grow much larger, and are far more prolific in the way of their natural increase, than those that were never cut. It is very common, when a polype is divided transversely, to see a young one push out from one or other of the parts, and sometimes from both of them, in a very few hours after the operation has been performed: and particularly from the tail part, two or three are frequently protruded in different places, and at different times, long before that part acquires a new head, and consequently whilst it can take in no fresh nourishment to supply them with; and yet the young ones proceeding from it, under these disadvantages, thrive as fast, and seem as vigorous, as those produced by perfect and uncut polypes."*

When such things were first announced—when to a little worm the attributes of angelic beings were assigned,† and the wild fictions of antiquity realized,‡—it is not wonderful that the vulgar dis-

* Baker, lib. s. cit. 92, 93.

† " Vital in every part, not as frail Man
In entrails, heart or head, liver or reins,
Cannot but by annihilating die;
Nor in their liquid texture mortal wound
Receive, no more than can the fluid air.
All heart they live, all head, all eye, all ear,
— — — — and, as they please,
They limb themselves, and colour, shape, or size
Assume, as likes them best." *Milton.*

‡ " Art thou proportion'd to the Hydra's length,
Who by his wounds received augmented strength?
He raised a hundred hissing heads in air;
When one I lopp'd, up sprung a dreadful pair;
By his wounds fertile, and with slaughter strong,
Singly I quell'd him, and stretch'd dead along."
Ovid. Metam. bk. ix. trans.

believed—albeit credulity may be their besetting sin—when even naturalists, familiar with all the miracles of the insect world, were amazed and wist not what to do. "Il faut," exclaimed Reaumur, "il faut porter la foi humaine plus loin qu'il n'est permis à des hommes éclairés, pour le croire sur le premier témoignage de celui qui le raconte, et assure l'avoir vu. Peut-on se resoudre à croire qu'il y ait dans la nature des animaux qu'on multiplie en les hachant, pour ainsi dire, par morceaux?"* But this illustrious naturalist was himself the first to promulgate, and experimentally to verify, the discoveries of Abraham Trembley, which have been fully confirmed by many subsequent inquirers, and are now made so familiar to us by their admission into elementary works and treatises on natural theology, that we read of them with little surprise and without incredulousness.

* Hist. des Insectes, vi. préf. 49.

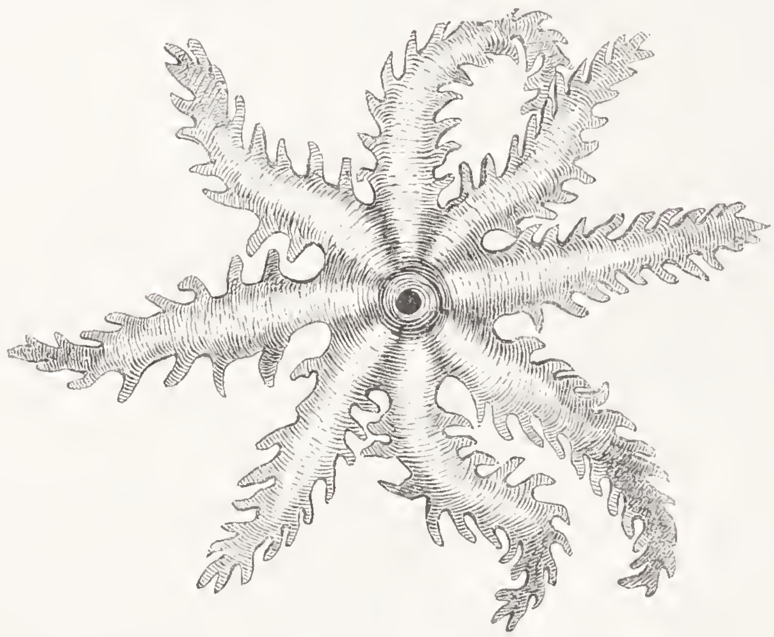
The only fossils which have been referred to this order of Zoophytes are the GRAPTOLITES. They were probably *Sertularinæ*, although this is still an unsettled point. They are "at present one of the most distinguishing fossils of the Silurian strata." Nine species are enumerated by Mr. Morris in his Catalogue of British Fossils; and the majority of them are figured in Captain Portlock's Report on the Geology of the county of Londonderry, pl. xix.

Fig. 30.

ANTHOZOA ASTEROIDA.

Zoocoralia Octactinia, *Ehrenberg*, Corall. des roth. Meer. 53. (1834.)—Les Alcyoniens, *Audouin* and *M. Edwards* in Lam. An. s. Vert. iii. 105. (1836.)—Zoophyta Asteroida, *Johnston* in Mag. Zool. and Bot. i. 447. (1836.)—Zoophytaria, *Blainville*, Man. 496. (1834.)—*Gray* in Syn. Brit. Mus. 131. (1842.)

Fig. 31.



On a cursory view the polypidoms of the three families embraced in this order appear very dissimilar, and accordingly, by many recent authors, they have been scattered over the class, and placed widely asunder. The affinity between them, however, is generally acknowledged, and had been distinctly perceived by some of the earliest zoophytologists. Thus Bohadsch found so much in common between the typical Pennatulæ and a species of Alcyonium, that he has not hesitated to describe them as members of the same genus; and although the more systematic character of Pallas prevented him falling into this error,—if error it can indeed be called,—he did not the less

recognize the relationship between the genera or families.* Pallas also tells us that his Pennatula cynomorium differs from the Alcyonium only in this, that the former is a moveable, and the latter a fixed polypidom ; and he saw with equal clearness the connection which exists between these genera and the shrub-like Gorgonia. Of the Pennatula mirabilis he had entertained doubts whether it was not rather a species of Gorgonia until he perceived that the stem was attenuated at each end and free ; and of the Sea-Pens generally, Ellis remarks, that they are "a genus of zoophytes not far removed from the Gorgonias, on account of their polype mouths, as well as having a bone in the inside, and flesh without." On the other hand, the Gorgoniæ, says Pallas, seem, with the exception of their horny skeleton, to be nearly similar in structure to the Alcyonia ; but as there are species of Gorgonia which are suberose internally and almost of a uniform medullary consistence, even this mark of distinction fails to separate the tribes, and we have little left to guide us in arranging these osculant species excepting their external habit, or, if we may so express ourselves, their physiognomy. Gorgonia Briareus has been described by some authors as an Alcyonium ; and Pallas would have enumerated the Gorgonia radicata in the same genus, had not its gorgon-like habit interfered. I am satisfied that no zoophytologist can examine Ellis's figure and description of Gorgonia suberosa without being convinced that it pertains rather to the congenerous family, or holds at least very debateable ground between them.

The names which the fishermen have conferred on the polypidoms of this order will convey to the student a better idea of their general appearances than any laboured description. The Pennatulæ in their language are Sea-Pens ; the Virgulariæ are Sea-Rushes ; Sea-Paps, Deadman's hand or Deadman's toes, if not agreeable, are yet expressive names for the Alcyonia ; and the Gorgoniæ are Sea-Shrubs when they branch

* "Pennatulæ Alcyoniis specierum gradatione ita propinquæ sunt, et tamen simul structura, habitu, vitæque sensitivæ gradu discrepant, ut exemplum majoris simul affinitatis et discordantiæ inter duo genera in rerum natura vix dari existimem. Certo respectu Pennatulæ ad Alcyonia sunt, quod Hydræ ad Sertularias." Elench. p. 362.—In relation to this paragraph, consult also p. 370, 343, 162, 191 ; and Misc. Zool. p. 177.

away irregularly, but when the branches inosculate and form a sort of net, they become Sea-Fans, which some naturalist, of more than our usual fancy, has appropriated to the use of Venus—Flabellum Veneris.*

In every polypidom of this order there are three parts which require notice,—the polypes, the fibro-fleshy calcareous crust in which they are placed, and the internal axis. The connection between these parts is indissoluble; and although we may treat of them separately, and as if they were somewhat independent, yet we must guard against the entertainment of any such opinion. It was once indeed a debated question whether each polypidom might not rightly be considered a mere aggregation of separate animalcules, but all that we know of their habits and structure goes to prove the contrary; so that no one probably now disputes that the polypidom with its polypes constitute but one body, the latter being in the place of as many mouths and stomachs scattered over the surface. The whole mass, with the exception at most of the axis in those which possess a stony or horny one, is living and organized, receiving the material of its nourishment and growth from the food captured and digested by the polypes; and as they have not only an organical union with the irritable flesh in which they are immersed, but are many of them more intimately associated together by means of canals and intestines, so they participate in every benefit and every evil. When, therefore, one pinna of a Sea-Pen is lacerated or cut away, the remaining pinnæ gradually shrink, the polypes withdraw, and the whole body contracts in every dimension; or if a portion of the Alcyonium be subjected to irritation, the gradual collapse

* Ray has especially called attention to the fan-like growth of submarine bodies. "That the motion of the water descends to a good depth, I prove from those plants that grow deepest in the sea, because they all generally grow flat in manner of a fan, and not with branches on all sides like trees; which is so contrived by the providence of nature, for that the edges of them do in that posture with most ease cut the water flowing to and fro; and should the flat side be objected to the stream, it would soon be turned edge-wise by the force of it, because in that site it doth least resist the motion of the water; whereas did the branches of these plants grow round, they would be thrown backward and forward every tide. Nay, not only the herbaceous and woody submarine plants, but also the lithophyta themselves affect this manner of growing, as I have observed in various kinds of coral and pori."—The Wisdom of God in the Creation, p. 77.

and contraction of the polypidom renders it obvious that the irritation has been communicated and felt through the entire mass.* On the contrary, when at rest and undisturbed, the polypes protrude their tentacula and a portion of the body, and, imbibing the circumfluent water, this percolates into the interior through numerous anastomosing canals, and distends the polypidom so much that it will more than double or treble its former size. In this respect the Anthozoa asteroida show an affinity to the Helianthoida, and differ from the hydraform and more especially from the ascidian orders.

The *axis* of the Alcyonidæ is imperfect, but exists nevertheless in the form of calcareous or siliceous spicula diffused through the gelatinous interior, or more or less densely clustered at the centre; and the appearance of these spicula is such that we are almost tempted to believe they may possibly be the products of crystallization rather than of any regular secretion.† It might not be difficult, but it is beyond my province, to trace the gradual increase and consolidation of these spicula through many intermediate species to the horny flexible axis of Gorgonia, where it has become such an efficient support to the whole soft envelope as to claim not improperly the name of its skeleton; thence to the stony axis of the coral; and having there reached its maximum of development, I might, on the other hand, have marked its progress towards degeneration until it became again only a partial support, such as we find it in the naked middle portion of the Pennatulidæ, more especially in some of the foreign and less typical species of that family.

* See "Reports" published by the Ray Society, p. 382. (1845.)

"Unknown to sex the pregnant oyster swells,
And coral-insects build their radiate cells;
Parturient Sires caress their infant train,
And heaven-born Storge weaves the social chain:
Successive births her tender cares combine,
And soft affections live along the line."
Darwin's Temp. of Nature, canto ii.

† They may be compared with the *Raphides* found in the intercellular passages of certain monocotyledonous plants. See Lindley's Introd. to Botany, p. 29.—Mr. Children found in the ashes of a piece of the axis of *Gorgonia flabellum* a distinct trace of pure silica, sufficient to form a globule before the blow-pipe.—Ann. of Philosophy, New Series, vol. ix. p. 431.

According to Lamarck, this axis, under all its modifications, is inorganic, containing neither vessels nor any portion of the body of the polypes, but formed of matter excreted by them, and afterwards thickened, solidified and depurated by affinity.* Although this is rather, on Lamarck's part, the deduction of theory than of observation, yet the opinion is in the main correct, and in correspondency with what had been long previously maintained by Ellis. In the spicula of Alcyonidæ certainly we can find no traces of organism, and they lie seemingly unconnected with the adjacent parts. The axis of Pennatula is a solid bone formed of laminæ laid over each other, softer and cartilaginous at each extremity where it seems to be organically connected with the soft surrounding flesh: it is evidently secreted, and deposited successively in layers, from the inner surface of a thin pellucid membrane which Bohadsch has described as investing it in the manner of a periosteum,† and probably is endowed with that low degree of vitality which preserves the horns, hairs and feathers of the higher animals in that elastic and fresh condition which they have only when in connection with living parts. The horny axis of Gorgonia, notwithstanding some observations of Ellis which apparently tend to a different conclusion,‡ is not more distinctly organized, and is doubtless formed in the same manner as the axis of Pennatula, for it is also of a lamellated structure, and, according to Lamouroux, is invested with a similar perios-

* Anim. s. Vert. ii. p. 78-80, 294, and 311.—Mr. Couch is of a contrary opinion. See his Corn. Faun. iii. p. 49.

† "Totum os membrana tenuis, lutescens, pellucida cingit, atque in utroque extremo in ligamentum contorquetur, quod ex una parte in apice trunci pinnati, ex altera vero in apice trunci nudi inseritur."—De Anim. Mar. p. 104. See also Corall. p. 214, 218, 224.

‡ "Proceeding thus far, I was led on to observe what kind of communication there was between the suckers (or polypes) and the bone of the animal. For this end I examined several specimens, both dry, as well as those that were preserved in spirits, with good magnifying glasses, and could distinctly trace an infinite number of minute winding canals, that lead from the suckers through the flesh into those parallel longitudinal tubes, which closely surround the bone or solid part on all sides. Perhaps these may not improperly be called the periosteum; for all along that side of those tubes by which they adhere to the bony part, I could discover the pores very plainly from whence the juices flow, that supply it with proper materials to answer this great end."—Soland. Zooph. 69. See also Couch's Corn. Faun. iii. p. 46-7.

teum.* A cross section of the stem or of a principal branch will show the layers to be disposed concentrically round a central medulla, the layers more or less compactly pressed according to the nature of the species (fig. 32). The whole section presents a certain resemblance to a similar section of a dicotyledonous tree (fig. 33): the medulla in position and outward appearance is a pith; the horny axis is the wood; and the fleshy crust has been denominated the bark; †—nor perhaps could fault be found with this language, since it is sufficiently illustrative, had it not been the mother of some very erroneous notions, and a great means of their propagation and continuance. Thus Linnæus, in his definition of Gorgonia, calls the axis a vegetating stem; and as if this was not sufficiently explicit, we find Pallas entering into detail, and telling us that the concentric circles are produced by successive transmutations of the fleshy crust, in the same manner that the circles of the wood of trees are formed by transformations of the inner layers of the bark.‡ And this opinion, if we may judge from their language, has been adopted by

Fig. 32.

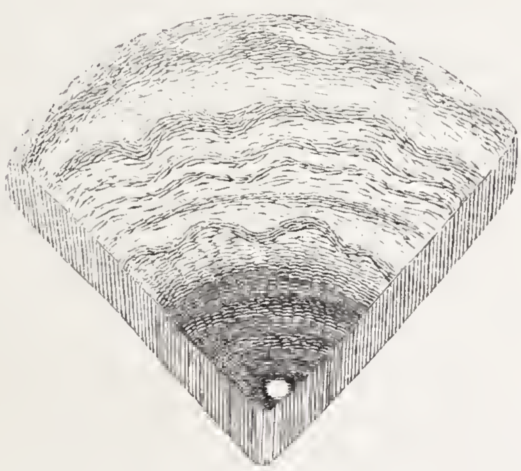
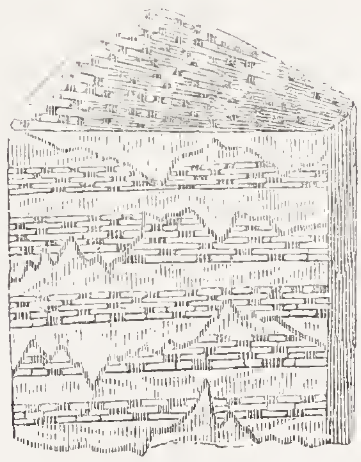


Fig. 33.



* "L'écorce des Gorgoniées ne se lie pas immédiatement à l'axe, elle en est séparée par une membrane d'une nature particulière, si mince dans le genre Gorgonia, qui'l est très-difficile de l'apercevoir; elle est plus apparente dans les Plexaures et les Eunicées."—Polyp. Corall. Flex. p. 391. Couch, lib. cit. p. 47.

† Lin. Syst. 1829.

‡ Elench. p. 162. He seems, however, to have had his suspicions that the theory was questionable, for he adds—"Quanquam diversissima corticis natura, ejusdemque facilis a ligno separatio, suggerere possent: hujus strata potius ex deposito intus succo fieri, aut lignum, prout ossa animalium sanguineorum intra periosteum, generari, augeri, durescere."

many, and even recent, authors; though Ellis had previous to its promulgation,* and also shortly afterwards, demonstrated that there was not only no real resemblance, but such remarkable differences as rendered the hypothesis altogether untenable.† The pith of the Gorgonia is not continued, as in the tree, from the trunk through the branches, but is interrupted at their origins by several intervening layers of fibres, so that they are rather, as it were, inserted upon the stem than propagations of it ; the axis possesses none of that curious complexity of structure.—of fibres, of sap and air vessels and utricular cells,—which renders the wood so beautiful an object under the microscope ; and lastly, there is between the bark and the crust of the zoophyte nothing but contrasts and discrepancies.‡

The axis of a Gorgonia, at least of our native species, resembles a tree in this, that the stem always bears a certain proportion in thickness to the size of the polypidom, being slender in the small, and thicker in the larger specimens : it tapers from the root or dilated base, and, becoming gradually more gracile and attenuated, disappears at the extreme points of the branches. It is covered throughout with the *flesh*, which is the same in structure at all points, but thicker and more loaded with polypes towards the ends of the branches than on the stem or near their base, whence the former generally assume a cylindrical form. This flesh when dry is earthy and friable, a considerable proportion of carbonate of lime entering into its composition ; but in a recent state it is soft and fleshy, and excavated with numerous cells for the lodgement of the polypes. When a portion of a branch is macerated in a weak acid, the lime is entirely removed, but the branch retains its original size and figure, and shows the frame-work to be an irregular close texture of corneous fibres, the interstices of which had been probably filled in part with a gelatinous fluid. And this is much the same structure that

* Coral. 65. Lin. Corresp. i. 225. Phil. Trans. (an. 1776) abridg. xiii. 721.

† What then could induce Blumenbach, so late as in 1825, to write thus ?—"The stems appear to be *really vegetables* (the woody nature of which in the larger ones cannot be mistaken) incrusted with corals."—Man. of Nat. Hist. Trans. p. 271.

‡ Ellis and Soland. Zoophytes, 76-79.

we find in the Alcyonium. The skin is coriaceous, strengthened with calcareous particles, but the interior offers a fibrous net-work containing a transparent jelly in the squares, and permeated with a certain number of longitudinal cartilaginous tubes. The soft part of Pennatula seems more uniformly fleshy or gelatinous, and its polypes are placed only on certain wings or appendages of the polypidom ; but the skin is also coriaceous, and has moreover in its substance a great number of calcareous spicula placed parallel to one another, and which must greatly add to its consistency and strength.

The *polypes* are placed in this external fleshy crust, which, indeed, is but a continuation of their tunic, and serves as a connecting medium to the whole assemblage. Their position in it is marked by an orifice on the surface distinguished by its being cut into eight rays in a starred fashion, and which open when the superior portion of the body is forced outwards.* This exsertile portion, in a state of expansion, resembles a cylindrical bladder or nipple crowned with a fringe formed by the eight short thick pectinated tentacula which encircle the mouth. (Plate xxxiv. Fig. 1.) Under this orifice we perceive the stomach, readily distinguished through the transparent parietes by its opacity, occupying the centre of the cylinder, and itself of a cylindrical figure. The space between it and the outer envelopes is divided into eight equal compartments or cells by as many thin ligamentous septa, which, originating in the labial rim, between the bases of the tentacula, descend through the cylinder, attached on the one side to the inner tunic of the body, and on the other to the stomach, which is by this means suspended and retained in its position. The canals or cells formed by these septa communicate freely with the tubulous tentacula above ; and they have a still wider communication with the abdominal cavity underneath the stomach, into which we may observe the septa are also continued for a certain way adhering still to the tunic, but free on their inner edges, for now, instead of septa, they form only the same number of plaits of more or less promi-

* See on this part of zoophytology Milne-Edwards, Mémoires " sur les Alcyons" in Ann. des Sc. Nat. iv. p. 333, &c. an. 1835 : and in the 2de édit. of Lam. Anim. s. Vert. ii. p. 465.

nence and width. Attached to them, and indeed forming a part of them, there are an equal number of twisted somewhat glandular filaments, which, originating round a small aperture in the base of the stomach, appear to be suspended in the cavity, gradually losing themselves in its depth. By most authors these have been mistaken for ovaries;* but though this assignation of function to them is easily proved to be erroneous, their true office remains conjectural. Milne-Edwards says they have great analogy with the biliary vessels of insects;† and some more recent anatomical naturalists maintain that they are analogous to the testes in the Actiniæ.‡

As already remarked, the protrusile portion of the polype is very delicate, the internal viscera being as it were enclosed in a serous bladder so transparent as to permit a view of their disposition. This envelope is itself, however, composed of two very thin membranes in intimate union: at the base of the body the outer of these assumes a considerable thickness, and, in coalescing with that of the adjacent polypes, constitutes the common cortical portion into which each animalcule retreats at will by a process of invagination, which we have had occasion already to compare to that by which a snail shortens its horns. (Plate xxxiv. Fig. 2.) In the greater number of the Asteroida this common portion secretes carbonate of lime, which is deposited in the meshes of its tissue either in granules or in crystalline spicula, and imparts more or less of consistency to the whole. The inner tunic on the contrary continues unaltered, and, prolonged within the polypiferous mass, it lines the cell, the abdominal cavity, and the longitudinal canals which permeate the mass, as well as the very fine tubular net-work with which the spaces between these canals is occupied (Fig. 5); for Milne-Edwards has shewn that there

* Cuvier, Reg. Anim. iii. p. 309, 310, 319. Lamarck gives us Savigny's opinion in the following passage:—"Les huit intestins d'un Polype semblent de deux sortes, car ils ne se ressemblent pas tous par la forme, ni vraisemblablement par les fonctions. Deux d'entre eux descendent distinctement jusque au fond du corps du Polype, et n'arrivent à aucun ovaire. Les six autres, plus variés dans leur forme, selon les genres, paraissent s'arrêter à six grappes de gemmules oviformes qui imitent six ovaires."—Anim. s. Vert. ii. p. 405-7, 417.

† Ann. des Sc. Nat. iv. p. 331.

‡ Owen's Lectures, p. 88.

is a free communication between these parts through the medium of numerous minute apertures perforated in the sides of the abdominal cavity.* It is in this tenuous inner tunic that the buds or gemmæ, by whose increase and evolution the polype-mass is enlarged, are generated, the shape and size of the mass depending upon the manner, or pre-ordained fashion, in which the buds are evolved; for in some, as in Pennatula, determinate spots only have the appropriated organization; while in others, as in Alcyonium, the generative faculty appears to be undefined and diffused. These buds are produced in the net-work of the crust; while the true ova, by which the species is propagated, always germinate from the inner surface of the lining of the canal that is prolonged into the common mass from underneath the abdominal cavity of the polype, and consequently in immediate communication with it. In Pennatulidæ we first detect the ova between the membranes of the polypiferous pinnæ; in Alcyonium in the cartilaginous canals which are traced through the polype-mass; and, in Gorgonia, Mr. Couch has shewn that their position is the same, in opposition to the assertion of Cavolini, who informs us that they germinate in eight distinct "ovaria at the base of each polypus." They first appear like a minute smooth wart, which gradually rises up from the surface, enlarging itself at the same time, and, when a certain size has been attained, the wart becomes constricted at its base, then shortly pedicelled, and at last it separates a free egg by the absorption of this retaining neck or umbilical cord. (Plate xxxiv. Fig. 6.) The eggs, now at liberty to move, gradually approach the base of the stomach, which, as already mentioned, is perforated with an opening that can be made wider, or closed by means of its sphincter muscle. After several approaches and as many repulsions, the aperture at length allows the egg to pass through into the stomach, whence it is ejected through the mouth into the open sea. Professors Grant and Milne-Edwards have witnessed this process in the Alcyonia, and the former also in the Pennatula and Virgularia; so that when Cavolini tells us that the ova of the Gorgonia pass upwards "through eight small oviducts," and are discharged, by

* Lam. Anim. s. Vert. ii. 465, 2de édit. Couch, Corn. Faun. iii. p. 52-3.

as many apertures, "between the bases of the eight tentacula,"* we may safely infer that there is an error in his observation,—which, moreover, is at variance with Mr. Couch's experience.†

The structure of the ova has been well described by Cavolini, and more especially by Professor Grant. Before their detachment they seem, in general, to be white: when mature they are almost always vividly coloured, globular, and apparently smooth, but clothed, as the microscope shews, with short ciliæ, which, by their vibration, cause them to move to and fro as if they were actuated by volition. They are membranous capsules filled with a gelatinous matter composed of very minute transparent globules similar to those which compose almost all the soft parts of animals, or like the sporules of the lower cryptogamic plants. The investing capsule is soft and irritable, for during their motions the ova are seen frequently to contract themselves and alter their form. "When placed under the microscope," says Professor Grant,‡ "and viewed by transmitted light, they appeared as opaque spheres surrounded with a thin transparent margin, which increased in thickness when the ova began to grow, and such of the ova as lay in contact united and grew as one ovum. A rapid current in the water immediately around each ovum, drawing along with it all loose particles and floating animalcules, was distinctly seen flowing with an equal velocity as in other ciliated ova, and a zone of very minute vibrating ciliæ was perceptible, surrounding the transparent margin of all the ova. The progressive motion of the ova, always in a direction contrary to that of the current created by their ciliæ, was very obvious, though less rapid than in any other zoophyte in which I have observed the same remarkable phenomenon. The specimen suspended in a glass jar filled with pure sea-water I now brought so close to the transparent side of the vessel, that I could examine through it, with the assistance of a powerful lens, and without disturbing the animal, the motions and pro-

* Edin. New Phil. Journ. i. 152.

† Corn. Faun. iii. p. 54.

‡ Dr. Grant's observations, quoted in the text, were made on Alcyonium digitatum; but the generalities may be safely applied to the other families, agreeing as they do with the observations of Cavolini on Gorgonia.

gress of the groups of ova passing through the colourless bodies of the polypi. To the naked eye at first sight all appeared motionless. The deep vermilion hue of the small round ova, and the colourless transparency of the outer covering of the polypi, formed a beautiful contrast with the pure white colour of the delicate longitudinal folds, the central open canal, and the slender filaments which wind down from its sides towards the clusters of white ova at the base; but the living phenomena discovered within were even more admirable than the beautiful contrast of colours, the elegant forms, and the exquisite structure of all the parts. When observed with a lens, the ova were seen to be in constant motion, and quite free within the bodies of the polypi. They moved themselves backwards and forwards, and frequently contracted their sides, as if irritated or capable of feeling. I could observe none passing upwards between the stomach and the sides of the polypi. They never assumed the appearance of a string of beads inclosed in a narrow shut curved tube, as represented by Spix, but swam freely in the water which distended the polypi, as figured by Ellis. Their motions in the polypi, though circumscribed, were so incessant, that by watching attentively I could observe them with the naked eye, and they became more conspicuous as the ova advanced to the open base of the stomach. From their restlessness, as they approached that last passage which separates them from the sea, they seemed to feel the impulse of a new element, which they were impatient to enjoy, and by following the direction of that impulse they appeared to find their way into the lower open extremity of the stomach, without any organic arrangement to lead them into that narrow canal. In their passage through the stomach, which was effected very slowly, the spontaneous motions of the ova were arrested, unless some imperceptible action of their ciliæ, or some contractions of their surface, might tend to irritate the sides of that canal, and thus direct or hasten their escape."*

* Professor Wagner thinks that "a disjunction of sex" in these polypes "admits of demonstration." "One of my companions," he says, "Dr. Erdl,(?) of Munich, found in *Veretillum* only females in one *polypary*, and in others only males. He writes me that he has afresh convinced himself of the same relation in *Alcyonium*, though the specimen had been preserved in spirit."—Ann. and Mag Nat. Hist. vi. p. 71.

Although it has not been proved that all Hydroid zoophytes are phosphorescent, yet they appear to be more generally so than the Asteroids, in which the power to produce light is limited, so far as is yet known, to one family. This is the Pennatulidæ, every member of which is luminous at will perhaps, although they light up their tiny lamps apparently only when under the influence of some painful irritation; * Will-o-the-wisps of the sea, put out to frighten feeble assailants. I have repeatedly kept living specimens for several days in sea-water, and have observed them at all hours, without once detecting them in a voluntary emission of the flame. From some experiments made on Pennatula phosphorea, Professor Edward Forbes draws the following inferences:—"1st, The polype is phosphorescent only when irritated by touch; 2d, The phosphorescence appears at the place touched, whether it be the stalk or the polypiferous part, and proceeds from thence in an undulating wave to the extremity of the polypiferous portion, and never in the other direction; 3d, If the centre of the polypiferous portion be touched, only those polypes above the touched part give out light; and if the extreme polypiferous pinna be touched, it alone of the whole animal exhibits the phenomenon of phosphorescence; 4th, The light is emitted for a longer time from the point of injury or pressure than from the other luminous parts; 5th, Sparks of light are sometimes sent out by the animal when pressed—these are found to arise from luminous matter investing ejected spicula."—Subsequent experiments did not always give the same results, for, as Mr. Forbes writes me, "unless the animal be in the highest state of vivacity, the stalk shews no phosphorescence, and the light of the feathered portion only runs a short way, but always towards the upper extremity. When plunged in fresh water, the Pennatula scatters sparks about in all directions,—a most beautiful sight;—but when plunged in spirits, it does not do so, but remains phosphorescent for some time, the light dying gradually away, and last

* Since the pages on the phosphorescence of the Hydroid zoophytes were printed off, I have received a letter from Professor E. Forbes, in which he says,—"The finest way of observing the phosphorescence of the Hydroids is to cast them into *fresh* water in the dark. The *vesicles*, when full and fresh, give out the most vivid light. This I have observed in several species of Sertularia."

of all from the uppermost polypes. One remained phosphorescent for five minutes in spirits." Interested with the beauty of the phenomena, Professor Forbes induced his friend, Dr. George Wilson, to enter on the inquiry into the cause of the phosphorescence, and this distinguished chemist has favoured me with the permission of publishing the result, which I am happy to do in his own words.

"The experiments recorded in the following statement were conducted several years ago, and I have not been able to recover the notes made at the period of their performance. I was assisted in making them by a very accurate observer, Mr. Swan, teacher of mathematics in this city, who is an excellent electrician, and concurred with me in the conclusions I am presently to state. As he had no bias in favour of the non-electrical, rather than the electrical, view of animal phosphorescence,—whereas, for reasons to be mentioned hereafter, I considered the latter as not likely to prove the true one,—his opinion, as founded solely on the negative results of our experiments, is of more value, so far as they are concerned, than my own.

"The experiments were undertaken at the request of our friend, Professor Edward Forbes, in consequence of the curious observation he had made, that when the Pennatula is struck or mechanically irritated, so as to cause it to phosphoresce, the light which shews itself, flows in a stream along the body of the animal from the point struck towards the plumed or fringed extremity, but not in the opposite direction. This passage of light along the animal seemed so like the result of an electrical current flowing constantly in one direction, that Mr. Forbes was anxious to have it ascertained whether or not a development of electricity accompanied the evolution of light.

"The form of the Pennatula rendered it more easy to make experiments on this subject, than I suppose it would be with many other phosphorescent animals. From Mr. Henry Goodsir, then at Anstruther, I received two different supplies of Pennatulæ; and on these the trials were made. Some of them, as I understood from Mr. Forbes, were in full life, and therefore in a fit condition for being employed in the inquiry.

Others had the membrane, or sac, surrounding the stem, flaccid and undistended by water, and I was informed were in a less lively condition. They phosphoresced, however, very readily when struck, and were used indiscriminately with the more vigorous ones in the experiments I made.

"These experiments were of a very simple kind. They consisted in placing the Pennatula in an insulating or non-conducting medium, and, whilst it was made to phosphoresce by touching it with a glass rod, placing it in communication with a delicate electroscope or galvanometer. The most convenient insulating medium for this purpose was the air, to which the Pennatula was transferred from the sea-water, and dried by blotting-paper or a soft towel. It was neither possible, nor was it attempted by this method, to remove the whole of the water from the surface of the animal; but the power of that surface to conduct electricity was, at all events, rendered exceedingly slight.

"Thereafter plates of platina, connected with each of the wires of a galvanometer, were placed on opposite sides of the animal, so as to receive and carry off any electrical currents generated by it.

"In no case was the needle of the galvanometer affected, although the position of the plates was varied greatly. One, for example, was placed on the one flat surface, and the other on the other, whilst the animal was made to phosphoresce. Again, whilst one of the plates was buried among the polypes at the plumed end, the other was made to irritate the animal near its quill-like extremity, so that the phosphorescing surface was between the plates; but the needle did not move. In short, no action on the galvanometer could be obtained by any method of treating the Pennatula.

"Similar experiments were made by immersing the Pennatula in turpentine, an excellent non-conductor, but with equally negative results.

"A number of trials were likewise made with gold-leaf electroscopes of different construction, one of which I had made of peculiar delicacy, solely for the purpose of trying the experiments I am recording. In using them the animal was simply dried, held by the stem, and, whilst it was phosphorescing powerfully, approached to the electroscope. The latter,

however, remained quite unaffected. I need not enter further into detail concerning experiments which gave without exception negative results.

"So far as the value of these trials is concerned, I would observe, that I by no means consider them as having been sufficient in number, or sufficiently carefully conducted to warrant a positive conclusion as to the non-electrical character of the light of the Pennatula. I was, at the period of their performance, a comparatively young student, and had neither the experience in conducting electrical researches, nor the command of so many or so delicate instruments as I could now make use of for the purpose I had in view. A negative result obtained in such circumstances cannot be considered as having a high value. Nevertheless, did I not consider the experiments I have recorded as having a positive worth, I should certainly not have published them even with the qualification I append to them. I make them public, however, because I feel quite certain of this, that to produce as long-continued and as bright a light as a single Pennatula will give out when it phosphoresces, by any artificial electrical process, would require an immensely greater amount of electricity than was necessary to affect the least delicate of my electroscopes. If a Pennatula be considered as evolving a small amount of electricity of high tension, like a friction electric machine, then, if we measure the quantity and tension of that electricity by the intensity and continuance of the light, it would powerfully affect the roughest pith-ball electrometer. On the other hand, if we look on the Pennatula as resembling rather a voltaic battery, and as evolving a large quantity of electricity of low tension, then it should deflect very energetically the needle of a galvanometer. Lastly, if we consider the Pennatula as possessing a power analogous to that of the electrical fishes to evolve electricity, both great in quantity, and high in tension, then measuring the amount of these, as before, by the intensity of the light, we should have powerful action both on the gold-leaf electrometer and on the galvanometer. As neither of these instruments, however, was affected in the slightest degree, I think my experiments are not without positive value. I should, notwithstanding, have abstained from publishing them until I had repeated them with additional care, had I

not deemed two phenomena so significant as to the non-electrical nature of the light of the Pennatula, as to render repetition of experiments needless. The one of these is the well-known fact that electricity produces light only when passing through or across a non-conductor, such as air. It is impossible, accordingly, to produce even the faintest luminous appearance in water, or a saline solution conducting a current, however gigantic the machine or battery supplying it be. I need only mention the failure of experiments with the friction machine in damp weather, to recall this fact. It is still more interestingly manifested by the circumstance that the electrical fishes are not in the least luminous, nor does any flow of light accompany their electrical discharges. On the other hand, it is only with difficulty, and after carefully insulating them, that small sparks are obtained from the torpedo or silurus; and the spark is obtained, not in the water, but out of it, that is *in air*.

"When a Pennatula is plunged into fresh water, it throws off, or detaches from itself, many calcareous spicula covered with mucus. Each of these phosphoresces, and continues to do so for hours, even for days. If any one affirm that these minute shining points are alive, I will not dispute the point with him, but will only ask at his hands some consistent theory which shall reconcile with known facts the possibility of the continuous luminosity of detached particles, such as the spicula are, depending upon electrical excitement. To maintain as much light, for so long a time, by any electrical instrument with which we are acquainted, even in the best non-conductor, would require an expenditure of force quite enormous. Everything I know of electricity is at variance with the possibility of such an expenditure of force being at work. I hold myself, therefore, justified in having never returned to an experimental inquiry into the cause of the phosphorescence of the Pennatula.

"On the whole I believe it most probable that the animal secretes a spontaneously inflammable substance. It may be a compound of phosphorus, but it is not necessary to assume that it is.

"The known relations of carbon and hydrogen to combustion are such as to make it quite possible, and even probable,

that some of them, or compounds of them with nitrogen and oxygen, should prove spontaneously inflammable. We require, however, not only a combustible, but likewise a supporter of combustion. I would suggest it as a subject well worth the attention of observers, to notice whether or not any bells or bubbles of gas shew themselves around the phosphorescing points of the Pennatula. It is possible that it may secrete air or oxygen along with the inflammable substance.

"The persistent luminosity of detached points is not against such an idea, for the combustion is *ex hypothesi* an extremely slow one, and the oxygen of the air secreted along with the combustible may suffice for its support for a long time. It is not necessary, perhaps, to assume a power of secreting oxygen. Air must be constantly separating from its state of solution in sea-water, and attaching itself to the Pennatula, and may suffice for maintaining the combustibility of its little lamps. I watched the Pennatulæ whilst phosphorescing with microscopes of considerable power, but could not detect any air-bubbles. I am quite unskilled, however, in the use of the microscope, and would suggest to those who are experienced in its use, the desirableness of repeating my observations on this point."

"24, Brown Square, Edinburgh,
"Dec. 17th, 1845."

Fig. 34.

OVA OF THE GORGONIA.

SYNOPSIS OF THE FAMILIES AND GENERA.

Family I.—*PENNATULIDÆ.* Polype-mass free, pennated, carnous; the skin spiculiferous; the axis bony, simple, continuous: polypes arranged along the margin of the pinnæ.

Polypes on bipennated wings :—

Polypidom plumous	PENNATULA.
Polypidom virgate	VIRGULARIA.

Polypes unilateral, sessile :—

Polypidom linear-elongate . . .	PAVONARIA.

Family II.—*GORGONIADÆ.* Polype-mass fixed, arborescent; the axis covered with a thick cretaceo-gelatinous celluliferous crust: polypes scattered over the whole surface.

Cells for the polypes immersed	GORGONIA.
Cells subpedunculated, protruded . . .	PRIMNOA.

Family III.—*ALCYONIDÆ.* Polype-mass fixed, coriaceous or somewhat carnous, without any distinct axis, but strengthened by variously disposed calcareous spicula: polype-cells subcutaneous, scattered over the surface.

Polypes aggregate	ALCYONIUM.
Polypes segregate	SARCODICTYON.

ANTHOZOA ASTEROIDA.

FAMILY—PENNATULIDÆ.

Pennatula, *Lin.* Syst. x. 818. *Pall.* Elench. 362. *Lin.* Syst. 1321.—Les Pennatules, *Cuv.* Reg. Anim. iii. 317.—Polypi natantes, *Lam.* Anim. s. Vert. ii. 413.—Pennatulidæ, *Flem.* Brit. Anim. 507. *J. E. Gray* in Syn. Brit. Mus. 132.—Pennæ marinæ, *Schweig.* Handb. 401.—Pennatularia, *Blainv.* Man. 512.—Calamites, *Latr.* Fam. Nat. 543.—Pennatulina, *Ehrenb.* Corall. des roth. Meer. 63.

16. Pennatula,* Cuvier.

Character. *Polype-mass free, plumous, the shaft subcylindrical, naked beneath, pennated above; pinnæ two-ranked, spreading, flattened, and polypiferous along the upper margin.*

1. P. phosphorea, *purplish-red, the base of the smooth stalk pale; rachis roughened with close-set papillæ and furrowed down the middle; pinnæ close; polype-cells uniserial, tubular, with spinous apertures.* Sir R. Sibbald.

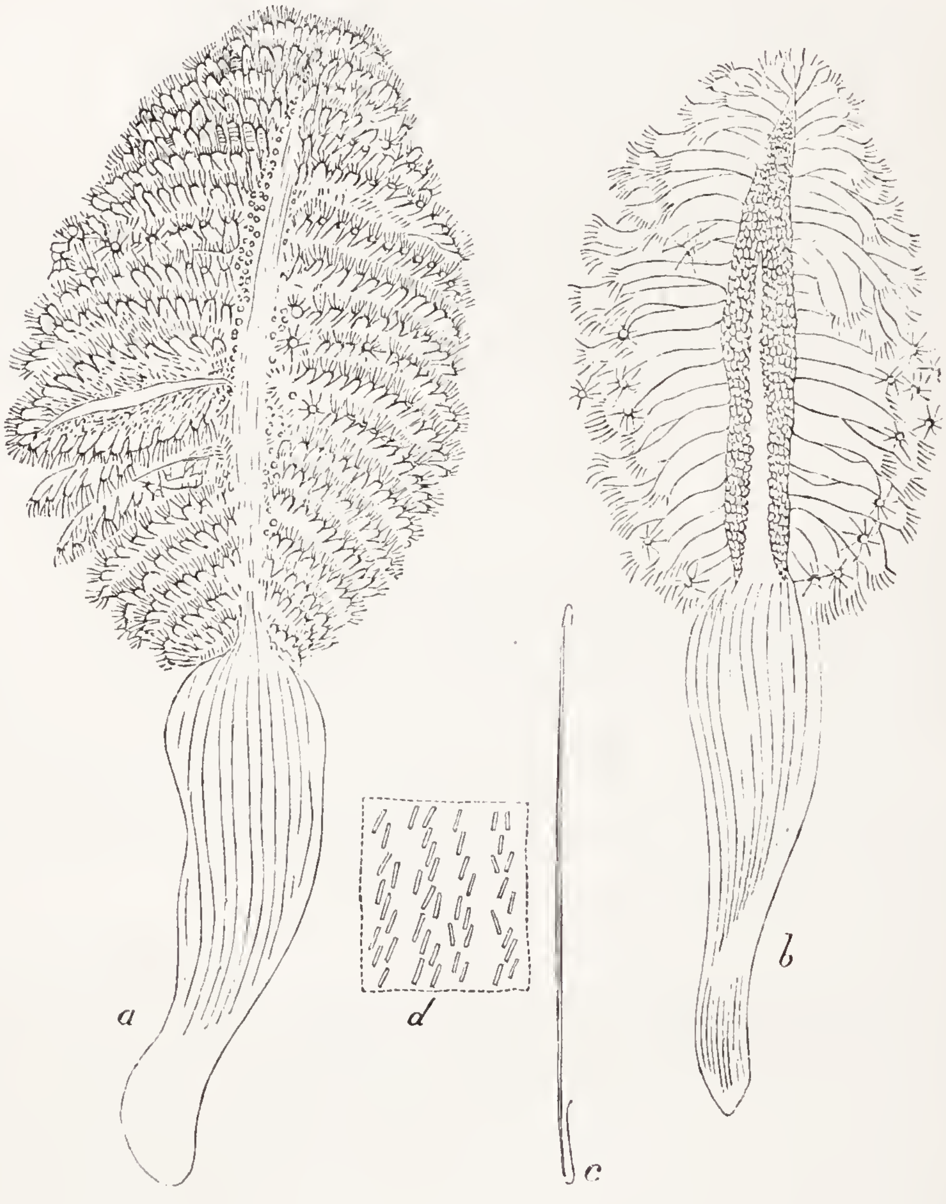
Penna marina, *Sib.* Scot. ii. lib. tert. 28.—P. rubra, *Bohad.* Anim. Mar. 101, pl. 8, fig. 1—3.—Pennatula phosphorea, *Lin.* Syst. 1332. *Ellis* in Phil. Trans. liii. 420, pl. 19, fig. 1—5. *Mull.* Zool. Dan. prod. 255, no. 3075. *Esper* Pflanz. Pennat. tab. 3, fig. 1—3. *Oliv.* Zool. Adriat. 294. Wern. Mem. i. 565. *Turt.* Brit. Faun. 217. *Stew.* Elem. ii. 450. *Blumenb.* Man. 274. *Lam.* Anim. s. Vert. ii. 426: 2de édit. ii. 643. *Cuv.* Reg. Anim. iii. 318. *Flem.* Brit. Anim. 507. *Stark* Elem. ii. 420. *Johnston* in Trans. Newc. Soc. ii. 248, pl. 7. *Roget* Bridgew. Treat. i. 174, fig. 71, 72. (bad.)—P. rubra, *Pall.* Elench. 368.—P. Britannica, *Ellis* and *Soland.* Zooph. 61.—Pennatole fosforea, *Delle Chiaie* Anim. s. Vert. Nap. iii. 4, and 11, tav. 31, fig. 15.

Hab. Deep water. "It is found in great plenty sticking to the baits on the fishermen's lines, round the coasts of this kingdom; es-

* Formed from *Penna*, a quill,—which the species so remarkably resemble that we may say in the words of Lamarck, "Il semble, en effet, que la nature, en formant ce corps animal composé, ait voulu copier la forme extérieure d'une plume d'oiseau."—Anim. s. Vert. ii. 425.

pecially when they make use of muscles to bait their hooks. Great numbers have been taken on the coast of Scotland, especially near Aberdeen," *Ellis.* Hebrides, *Mr. MacAndrew.* Zetland, *E. Forbes.* It has not been found in Cornwall, nor perhaps in Devon; and is probably rare in the south of England.

Fig. 35.



Our fishermen call this zoophyte the *Cock's-comb,* a name which is not unapt, but less expressive of its general form than that of Sea-pen conferred by naturalists. It is from two to four inches in length, and of a uniform purplish-red colour, except at the tip or base of the stalk, where it is pale orange-yellow. The skin is thickish, very tough, and of curious structure, being composed of minute crystalline cylinders, densely arranged in straight lines, and held together by a firm gelatinous matter or membrane. These cylinders are about six times their diameter in length, straight and even, or sometimes

slightly curved and bulged, closely compacted yet distinct, and of a red colour; for the colour of the zoophyte is derived from them, and they are accordingly less numerous where the purple is faint or defective. They are apparently inorganic and calcareous, being dissolved, with effervescence, in the mineral acids.* Their form and arrangement is the same in every part of the skin; and the papillæ on the back of the rachis, as well as the polype-cells, are constructed of them, but none can be detected in the subcutaneous uncoloured gelatinous flesh.

The stalk is hollow in the centre, and contains a long slender bone, which is white, smooth, square, and tapered at each extremity to a fine point. It seems intended to stiffen the polypidom, but it does not extend the whole length of the stalk, for before it reaches either end, the point is bound down and bent backwards like a shepherd's crook. It consists, according to Sir E. Home, of phosphate and carbonate of lime, making thus a near approach to the bone of vertebrate animals. Lect. Comp. Anat. i. p. 59.

The papillæ on the back of the rachis, and between the pinnæ, are disposed in close rows, and do not differ from the polype-cells except in size. The latter are placed along the upper margin of a flattened fin; they are tubular, and have the aperture armed with eight spinous points, which are moveable, and contract and expand at the will of the animated inmates. These are fleshy, white, provided with eight rather long retractile tentacula beautifully ciliated on the inner aspect with two series of short processes, and strengthened moreover with crystalline spicula, there being a row of these up the stalk, and a series of lesser ones to the lateral ciliæ. The mouth, in the centre of the tentacula, is somewhat angular, bounded by a white ligament, a process from which encircles the base of each tentaculum, which thus seems to issue from an aperture. The ova lie between the membranes of the pinnæ; they are globular, of a yellowish colour, and by a little pressure can be made to pass through the mouth.

Bohadsch says that the Pennatulæ swim by means of their pinnæ,

* Dr. Coldstream, of Leith, on whose observations I place a greater reliance than on my own, writes me thus :—"The spicula of the Pennatula appear to me to be *solid*. I have examined them with high powers, after having exposed them to a high temperature, and have not been able to see any evidence of a cavity within ;—whether viewed with reflected or transmitted light, they seemed to be opaque. When connected with the body of the animal, they certainly seem to be red ; but a slight degree of heat is sufficient to bleach them."

which they use in the same manner that fishes do their fins. Ellis says it "is an animal that swims freely about in the sea," "many of them having a muscular motion as they swim along;" and in another place he tells us that these motions are effected by means of the pinnules or feather-like fins, — "these are evidently designed by nature to move the animal backward or forward in the sea, consequently to do the office of fins."— Phil. Trans. abridg. xii. 42. Pallas adopted, with some reservation, (Misc. Zool. p. 177,) the opinion of Bohadsch; but Bosc, in an effort to be original, fancied that these remarkable zoophytes lay during the winter at the bottom, concealed among sea-weed and in the crevices of rocks, while in summer they often swam at the surface! Cuvier tells us that they have the power of moving by the contractions of the fleshy part of the polypidom, and also by the combined action of its polypes; and, to adopt the words of Dr. Grant, "a more singular and beautiful spectacle could scarcely be conceived, than that of a deep purple Pen. phosphorea, with all its delicate transparent polypi expanded and emitting their usual brilliant phosphorescent light, sailing through the still and dark abyss by the regular and synchronous pulsations of the minute fringed arms of the whole polypi." And Bohadsch asserts that he has been a witness of this spectacle. "Deget nostrum *Zoophyton* in altiori mari, ubi interdum cum aliis piscibus capitur. Dum versus maris superficiem fertur, bullulæ innumeræ corpus ejus circumdant, quæ stellarum instar de die splendent; id quidem non hac occasione, sed anno 1749, dum Liburno Marsiliam versus per mare proficiscerer, observavi. Quo tempore in historia naturali minime versatus corpus bullulis nitens ad quatuor circiter pedes infra superficiem maris conspiciens e nautis quæsivi, quidnam rei esset? qui *Pennam* esse pro responso dedere." An. Mar. p. 107.—Linnæus had therefore some grounds for inserting the "phosphorescent Sea-Pens, which cover the bottom of the ocean, and there cast so strong a light, that it is easy to count the fishes and worms of various kinds sporting among them"—amongst the most memorable productions in Nature. See Smith's Tracts relating to Nat. History, p. 43. But some authors, as Lamarck and Schweigger, reasoning from what is known regarding other compound animals, have denied the existence of this great locomotive power in a zoophyte placed so low in the scale, as contrary to every analogy, and not necessary to the existence or wants of the animal. And there is little doubt these naturalists are right, for, when placed in a basin or plate of sea-water, the Pennatulæ are never observed to change their position, but they remain

on the same spot, and lie with the same side up or down just as they have been put in. They inflate the body until it becomes to a considerable degree transparent, and only streaked with interrupted lines of red; they distend it more at one place, and contract it at another; they spread out the pinnæ, and the polypes expand their tentacula, but still they never attempt to swim or perform any effort towards locomotion. Our fishermen believe that they are fixed at the bottom with their ends immersed in the mud; and the paleness of the base, when viewed in connection with the preceding observations, goes far, in my opinion, to prove this statement to be correct. "Si les pennatules nagent aussi," says Blainville, "ce dont je doute un peu, quoiqu'elles rampent trés-lentement, c'est peut-être en chassant le fluide qui est entré dans leur système acquifère, plutot qu'á l'aide des pinnules polypifères."—Actinolog. p. 83.

17. Virgularia,* Lamarck.

Character.—*Polype-mass free, linear-elongate, "supporting, towards the upper extremity, sessile lunate lobes embracing the stem obliquely, and bearing a row of cells on their margin."*

1. V. mirabilis, "*stem filiform, with alternate lobes transversely ridged.*" Mr. Simmons.†

Plate XXX.

Pennatula mirabilis, *Lin.* Syst. 1322. *Mull.* Zool. Dan. i. p. 11, tab. 11, fig. 1—3. *Ellis* and *Soland.* Zooph. 63. *Sowerby* Brit. Misc. 51, pl. 25. *Jameson* in Wern. Mem. i. 565.—Virgularia mirabilis, *Lam.* Anim. s. Vert. ii. 430: 2de edit. ii. 647. *Flem.* Brit. Anim. 507. *Grant* in Edin. Journ. of Science, no. 14.—Scirpearia mirabilis, *Templeton* in Mag. Nat. Hist. ix. 470.—La Virgulaire à ailes laches, *Blainv.* Actinol. 514, pl. 90, fig. 3.

Hab. Dredged up by Mr. Simmons off Inch-Keith, *Sowerby.* Prestonpans Bay, *Jameson.* "On the east and north coast of Scotland, where it is believed by the fishermen to have one end lodged erect in the mud; in Zetland it is called the Sea-rush," *Fleming.* Gairloch, *James Smith, Esq., of Jordan-Hill.* Near Oban, *Mr. MacAndrew.* Dredged up in Belfast Lough, *Templeton.* "Is most abundant in Belfast Lough, several being sometimes taken in a single haul of the dredge; but from their brittle nature, it is difficult to get

* Formed from *Virgula*, the diminutive of *Virga*—a rod.

† "A young man who has since fallen a sacrifice to his zeal for Natural History in the West Indies."—*Leach.* He was, I believe, a native of Edinburgh.

perfect specimens ; the range of their habitat is from Holywood to Bangor Bay, but in the two extreme points they are met with in the greatest plenty ; their favourite place of residence seems to be a soft muddy bottom, being rarely met with on a sandy one ; in one specimen forwarded by me to the Royal Dublin Society, the animal has the appearance of a Shepherd's Crook, being turned up for two inches at the base of the axis." *W. M'Colla.*

" Seems to represent a quill stripped of its feathers. The base looks like a pen in this as in the other species, swelling a little from the end, and then tapering. The upper part is thicker, with alternate semi-circular pectinated swellings, larger towards the middle, tapering upwards, and terminating in a thin bony substance, which passes through the whole." *Sowerby.*—" From six to ten inches in length." " They perfectly correspond in form and external appearance with the elegant coloured figure given by Muller. Their *axis* is calcareous, solid, white, brittle, flexible, cylindrical, of equal thickness throughout, and exhibits no mark of attachment at either end. When broken, it exhibits a radiated surface, like the broken spine of an echinus. The axis appears to have little connection with the fleshy part, and to consist of concentric layers deposited by the soft parts surrounding it. When a portion of the axis is broken off from either extremity, the animal retracts at that part, so as continually to expose a fresh naked portion of the axis : hence we can take out the axis entirely from its soft sheath, and we always find the lower pinnæ of the animal drawn up closely together, as if by the frequent breaking of the base. These very delicate and brittle animals seem to be confined to a small circumscribed part of the coast which has a considerable depth and a muddy bottom, and the fishermen accustomed to dredge at that place believe, from the cleanness of the Virgulariæ when brought to the surface, that they stand erect at the bottom with one end fixed in the mud or clay. Muller's specimens were likewise found on a part of the Norwegian coast with a muddy bottom.* The *Polypi*, much resembling those of the common Lobularia digitata, are long, cylindrical, transparent, marked with longitudinal white lines, and have eight tentacula which present long slender transparent filaments or ciliæ on each of the lateral surfaces

* That the Virgularia lives partially immersed in the mud, seems to be proved by the observations of Mr. C. Darwin. See Voyage of the Adventure and Beagle, iii. p. 117. Muller positively asserts the fact.—" Basis seu extremitas fundo argilloso infixa ex parenchymate carnosiori seu lamellis, quarum Hydræ nondum evolutæ sunt, crassior ac utrinque serrulata est."

when fully expanded. The polypi are easily perceived extending through the lateral expansions or pinnæ, to near the solid axis, where we observe two transverse rows of small round white ova placed under each pinna, and contained within the fleshy substance. These ova appear to pass along the pinnæ, to be discharged through the polypi, as in the Lobularia, Gorgonia, Caryophyllea, Alcyonia, &c." *Grant.*

The figures in our plate were drawn from specimens with which I was favoured by Dr. Coldstream, and which had been preserved for some time in spirits; but to shew the difference between the animal in this contracted condition and when alive, I have placed beside them figures 5 and 6, copied from Muller. The dissimilarity between figures taken in these different states has rendered the synonymy of the species perplexed and almost inextricable. According to Cuvier, Lamarck, and Blainville, the species delineated by Muller, and which is certainly identical with the British one, is not synonymous with the Linnæan; but this opinion rests solely upon the circumstance of Linnæus having quoted a figure in the "Mus. Ad. Fr."—belonging confessedly to another Zoophyte—as a representative of the species he intended, which may have been done from the then uncertainty of the limits of the species, or from having seen specimens in spirits only. His character is very applicable to our animal,—"*P. stirpe filiformi, rachi distiche pennata: pinnis lunatis remotis alternis;*" and the habitat "*in O. Norvegico,*" seems to confirm the reference.

I am indebted to Mr. R. Patterson of Belfast, for the following remarks:—"I notice that your figures of the Virgularia, are from specimens preserved in spirits, and that to give an idea of the living Zoophytes, you copy a part of Muller's delineation. Now, beautiful as Muller's figure is, it does not do justice to the living appearance of the animal. The translucid part is shewn by Muller *plain,* while even to the naked eye, it exhibits about eight delicate lines, more transparent than the adjoining parts. His figure, too, represents each plume (if I may use the phrase,) in precisely the same *position* and same degree of *expansion,* but the fact is, that in the very longest specimen I had, which I suppose was nine or ten inches, no two were precisely alike;—nay, they were so unlike, that a young lady who, at my request, made the little drawing I now inclose, (Pl. xxx. fig. 7.) when she raised her eyes from her paper to look at the animal, never found a moment's hesitation as to what particular plume she was depicting. All were so *unlike,* that there was no mistaking one

for the other. I kept my specimens in sea-water until they died, and in their relaxed state, they resembled Muller's figure, but not while vigorous."

Virgularia differs from Pennatula remarkably in this that no spicula enter into the composition of its soft parts. The polypiferous pinnules are secund, leaving the posterior part naked, and this is marked with a deep furrow extending from one end to the other, dividing the polypidom into two symmetrical halves.

18. Pavonaria,* Cuvier.

Character.—*Polype-mass linear-elongate, quadrangular; Polypes sessile, retractile, arranged subspirally on one side only of the posterior half of the rachis: Tentacula with intermediate spinules.*

1. P. quadrangularis. Mr. MacAndrew.†

Plate XXXI.

Pennæ species, *Bohads.* An. Mar. 112, tab. 9, fig. 4, 5.—Pennatula quadrangularis, *Pall.* Elench. 372.—Pennatula antennina, *Lin.* Syst. 1323. *Ellis* and *Soland.* Zooph. 63.—Funiculina tetragona, *Lam.* An. s. Vert. ii. 2de edit. 641. — Pavonaria antennina, *Schweig.* Handb. 435. *Ehrenb.* Corall. des roth. Meer. 64. — Pavonaria quadrangularis, *Blainv.* Actinol. 516, pl. 90, fig. 1. (copied from Bohadsch). *Forbes* in Ann. Nat. Hist. xiv. 414.

Hab. The west coast of Scotland, *Mr. MacAndrew.*

Professor E. Forbes has described this remarkable species from a fine specimen intrusted to his care by Mr. MacAndrew. He says: "The specimen in question is a slender, flexible rod, no less than two feet six inches in length, and consists of an acutely quadrangular calcareous skeleton invested with animal matter, consisting of a general integument and three series of sessile but exserted polypes arranged unilaterally, the position of the ranges corresponding to three of the angles of the stem. The animal matter in the dried state is of a yellow colour and the skeleton white. It was taken both dead and alive in twenty fathoms' water off the island of Kerrera near

* Formed from *Pavo*, a peacock.

† Mr. MacAndrew of Liverpool, who has made some of the most interesting of the recent additions to the British Fauna. Professor E. Forbes has named a beautiful little shell *Eulima MacAndrei*, in acknowledgement of the services of this gentleman to Natural History (Ann. & Mag. N. Hist. xiv. p. 412), and the name must enhance the value of the species in the eyes of every genuine collector. I like these names which have a "reminiscential evocation."

Oban, the bottom being mud, in which it doubtless stands erect after the manner of *Virgularia*. Before a fuller description can be drawn up, specimens must be examined in the living state or preserved in fluid. In the meantime I offer the following remarks on the history of the species.

" It was first described by Bohadsch in his interesting work 'De quibusdam animalibus marinis' (1761), who states that he procured it from the fishermen at Naples, who call it '*Penna del pesce pavone*." He describes his specimen as two feet ten inches in length, although broken short. He gives a rude figure taken from a living specimen. He describes the skeleton as friable, " ex pasta veluti farinacea compactum videtur."—" Os hocce quadratum, candidum, membrana lutescens, falso sapore donata immediate investit, quam cutis coriacea dimidiam circiter lineam crassa undique circumdat. Inter utramque membranam in vivo animali quemdam humorem continerit, atque formam totius *Pennæ* cylindricam esse opinor, et quidem ex eo, quod *Pennæ rubræ*, &c. mortuæ et exsiccatæ truncus quoque aliter configuratus sit, quam in Penna viva observetur" (p. 112). He states that the polypes have eight white, not very prominent tentacula, and are arranged on three sides of the trunk. In 1766 Pallas gave a diagnosis of this zoophyte, under the appropriate name of *Pennatula quadrangularis*, in his 'Elenchus Zoophytorum,' adding the remark, " vidi fere bipedale.' Subsequent authors seem to have described it at second hand."—*E. Forbes.*

In a letter I have recently received from Professor Forbes, he writes thus of the Pavonaria :—" It lives erect, its lower extremity, as it were, rooted in slimy mud, at a depth of from twelve to fifteen fathoms, near Oban, Argyleshire, and only there, so far as we know. The largest specimen taken was forty-eight inches in length.

" The whole rod when alive, invested with a fleshy skin, is very slimy. Its base or root is cylindrical, of a yellow colour, and terminates somewhat obtusely and bulbous. The lowest polypes on the rod are very small, and in a single row on each side, but they gradually increase in size, and become more numerous, till they form oblique transverse rows of four, five, or six polypes in a row, the outermost being largest. The back of the rod is yellowish, smooth, and free from polypes. The polypiferous part is of a rose colour.

" Each polype is slender and cylindrical. It has eight tentacula surrounding an oval disk. They are pinnate, (the pinnæ about twenty on each side, and crenate,) and retractile within a sheath, the margin of which is strengthened by interlacing spicula, forming

triangular bristling tooth-like lobes which alternate with them. The tentacula are pale pink, solid, and formed of a granular tissue. Below the oral circle, the body is cylindrical, and marked by eight rose-coloured lines, and at about half its height, it dilates into a broader bottle-shaped base, within which are seen the bright red ovaries. The base gradually passes into the investing skin of the rod, of which the sheath of the polype and its teeth, may be regarded as an extension.

" Young specimens have much fewer polypes than old ones.

" When irritated, the Pavonaria gives out a vivid blueish light, which is brightest towards the tip. The light appears to come from the bases of the polypes, and to be connected with the reproductive system."

FAMILY—GORGONIADÆ.

Ceratophytes, *Cuv.* Reg. Anim. iii. 309.—Polypiers corticiferes, *Lam.* An. s. Vert. ii. 288.—Gorgoniadæ, *Flem.* Brit. Anim. 511.—Ceratophyta corticosa, *Schweig.* Handb. 432.—Corallia, *Blainv.* Man. 501.—Ceratocorallia s. Gorgonina, *Ehrenb.* Corall. 133.—Coralliadæ, *J. E. Gray* in Syn. Brit. Mus. 135.

19. Gorgonia,* Linnæus.

Character.—*Polype-mass rooted, arborescent, consisting of a central axis barked with a polypiferous crust : the axis horny, continuous and flexible, branched in coequality with the polype-mass : the crust when recent soft and fleshy, when dried porous and friable : the orifices of the polype-cells more or less protuberant.*

1. G. verrucosa, *somewhat fan-shaped, much and irregularly branched, the branches cylindrical, flexuous, barked when dry with a white warted crust : segments of the cells unequal, obtuse.* Cole.†

Plate XXXII. Fig. 1.

Frutex marinus flabelliformis, *Raii* Hist. Plant. iii. 7. *Sir H. Sloane* in Phil. Trans. abrid. (an. 1746) ix. 198, pl. 4, fig. 4.—Keratophyton flabelliforme, cortice verrucosa obductum, *Raii* Syn. 32.—Erica marina alba frutescens, *Petiv.* Mus. cent.

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* From *Gorgon*—the name of a daughter of Phorcys, whose locks of hair were changed into serpents by Minerva.

† Ray, in his Historia, mentions Mr, afterwards Dr. Cole of Bristol, as the finder of this zoophyte on the coast of Cornwall. Cole is well known to naturalists by his ingenious enquiry into the purple liquor of the Purpura lapillus.

prim. 9, no. 50.—Lithophyte second, 3 and 8, *Mars.* Hist. Phys. de la Mer, p. 93, pl. 17, fig. 81 ; p. 96, pl. 18, fig. 82 ; p. 104, pl. 21, fig. 97—100.—Warted Sea-fan, *Borl.* Cornw. 238, tab. 24, fig. 1.—Gorgonia verrucosa, *Lin.* Syst. 1291. *Pall.* Elench. 196. *Ellis* and *Soland.* Zooph. 89. *Esper* Pflanz. Gorg. tab. 16, fig. 1, 2. *Cavol.* Polyp. mar. 29, tav. 1, fig. 1-11, and tav. 4, fig. 1-16. *Lam.* Anim. s. Vert. 2de edit. ii. 491. *Lamarck* in Mém. du Mus. ii. 82. *Flem.* Brit. Anim. 512. *D. Chiaie* Anim. s. Vert. Nap. iii, 24 and 27. tav. 33, fig. 4-7. *Couch* Zooph. Cornw. 26 : Corn. Faun. iii. 56, pl. 12, fig. 1.—Gorg. viminalis, *Sower.* Brit. Misc. 81, pl. 40.—Eunicea verrucosa, *Ehrenb.* Corall. 136.

Hab. Deep water. "Mount's Bay in Cornwall," *Mr. Batten.* "Abundant along the whole of the south coast," *Couch.* Plentiful on the Devonshire coast, *Montagu.*

Polype-mass more than twelve inches in height, and fifteen or seventeen in breadth, fixed to rocks by a broad circular fibro-corneous disk, shrub-like, branched from near the base, the branches expanded laterally, sometimes bushy, cylindrical, erect or erecto-patent, warty. Axis black, smooth and somewhat glossy, round or a little compressed, compact and corneous, with a snow-white pith in the centre, irregularly cellular and very like the pith of a rush; near the extremities of the branches the axis appears to be a single tube striated longitudinally, but this appearance is produced by drying, for when steeped in water the striæ are removed; it is often bulged or knotted at uncertain intervals, but no pores can be detected in its parietes. Crust, in dried specimens, white, cretaceous, friable, warted, with numerous polype-cells and wrinkled in the small spaces between them; thickest towards the ends of the branches which it covers over. "When living, the external fleshy crust is soft, and of a flesh tint." Cells partly filled with a yellowish fibrous substance being the remains of the polypes, their orifices closed with eight converging obtuse small segments, one of which is so much larger than the others as to occupy a half or a third of the whole circumference.

Of Gorgonia verrucosa and viminalis, Mr. Couch says :—"Having specimens of both marked by Mr. Sowerby, I have been enabled to examine them under very favourable circumstances. Having compared together upwards of seventy specimens of each, of all sizes, I am inclined to agree with Fleming and Johnston, that they are but variations of the same species."—The *Gorgonia viminalis* of Pallas (*Esper*, Gorg. tab. 11.) is a very different species, although the variety represented in Esper's plate, 11 A. has a great resemblance to Gorg. verrucosa.

Mr. Couch has given many interesting particulars of this species, for which I must refer the naturalist to his valuable Cornish Fauna.

2. G. pinnata, *branched and pinnated, the branches compressed; polype-cells in regular rows on each margin, mammilate, unarmed.* E. Forbes.

Plate XXXIII. Fig. 1—3.

Gorgonia pinnata, *Lin.* Syst. edit. x, 802. *Lin.* Syst. 1292. *Mull* Zool. Dan. prod. 254. *Ellis* and *Soland* Zooph. 87, tab. 14, fig. 3. *Rathke* in Mull. Zool. Dan. iv. 37, tab. 153.

Hab. Attached to stones in thirty fathoms, in the Sound of Skye, *Mr. MacAndrew* and *E. Forbes.*

Polypidom arising from the centre of a thin circular corneous base, four inches and upwards in height, sparingly branched, slender and flexile, the branches irregular, compressed, a very little enlarged at the extremity: axis horny, filiform, of the thickness of sewing thread, smooth, blackish on the lower part, but becoming paler upwards, and almost yellow towards the apices: crust cretaceous, friable and easily separating from the axis, dull white, mealy, from a line to one-eighth in thickness, rendered almost moniliform or beaded by its thinness or constriction between the polype-cells: these are placed in a row along each side, obtusely mammillate, smooth, with an octoradiated aperture.

This description is made from a dried specimen presented to me by Professor E. Forbes.

"When taken alive it was of a cream-white colour. The polypes are white, with eight dull white granular pinnated tentacula: they are very sluggish, and did not expand."—*E. Forbes.*

The specific name is inapplicable to it, and I have quoted few synonymes from a suspicion that the pinnated branchy specimens from the tropical seas may possibly be of a different species. Certainly, however, the figure of the latter in Ellis' work gives a good idea of even our dwarfed and scarcely ramous denizen of the Scottish coasts, when regard is had only to the form and structure of an individual branch, and the habit of the whole is kept out of view.

Professor Forbes has suggested (and the suggestion is probably true), that this may be the Gorgonia viminalis, which is said by Dr. Walker to occur in Scotland; (Wern. Mem. i. 560.) and which Mr. Sowerby says he had also received from that part of our island.

3. G. placomus, *irregularly branched, the branches disposed in a dichotomous order and a flattish form, cylindrical, warty; cells protuberant, conical, surrounded at top by little spines.* Ellis.

Plate XXXII. Fig. 2.

Warted Sea-fan, *Ellis* Corall. 67. no. 1. t. 27. fig. *a, A*. 1, 2, 3.—Gorgonia placomus, *Pall.* Elench. 201. *Lin.* Syst. 1290. *Ellis* and *Soland.* Zooph. 86. *Esper* Gorgon. tab. 33, 34, and 34 A. *Lamarck* in Mém. du Mus. ii. 83. *Lam.* Anim Vert. ii. 316: 2de edit. ii. 492. *Flem.* Brit. Anim. 512. *Couch* Zooph. Cornw. 25: Corn. Faun. iii, 55, pl. 12, fig. 2.

Hab. Coast of Cornwall, *Ellis.* "Ellis must have been very fortunate to obtain a specimen on this coast, for after examining many scores of Gorgoniæ from the English channel, I have not seen a single specimen, and Mr. Peach of Goran informs me that he has never seen a specimen, so that on the south coast at least it is very rare." *R. Q. Couch.*

"This Sea-Fan is of a reddish brown colour;" "has its branches disposed in a dichotomous order and a flattish form; they bend irregularly towards one another, but rarely unite. Their mouths are conical, project, and are surrounded at top by little spines. The bone or support is nearly of the substance of wood." *Ellis.*

4. G. anceps, *branched, subdichotomous; branches with the flesh flat on each side, with a row of little mouths along both the margins.* Mr. Dale.*

Plate XXXII. Fig. 3.

Keratophyton dichotomum; caule et ramulis leviter compressis, *Raii* Syn. 32.—Sea Willow, *Ellis* Corall. 68. no. 2, tab. 27, fig. *g*.—Gorgonia anceps, *Pall.* Elench. 183. *Ellis* and *Soland.* Zooph. 89. *Lin.* Syst. 1292. *Esper* Pflanz. Gorg. tab. 7, fig. 1-3. *Lam.* Anim. s. Vert. ii. 317 : 2de edit. ii. 494. *Lamour.* Cor. Flex. 395. *Lamarck* in Mém. du Mus. ii. 84. *Flem.* Brit. Anim. 512.—Pterogorgia anceps, *Ehrenb.* Corall. 145.

Hab. Deep water, very rare. Found by Mr. Dale growing near Margate, *Dillenius.* Now and then found on the coast of Great Britain and Ireland; but not frequently, *Ellis.*

"This Gorgon is branched nearly in a subdivided manner." "The

* "Samuel Dale, Medicus et Pharmacopœus vicinus et familiaris noster, Bantriæ in Essexia degens," one of the four botanists to whom Ray acknowledges his greatest obligations in the compilation of his "Historia Plantarum." *Præf.* 1686.—He died in 1739, æt. 80. Petiver affectionately styles him "my very kind friend," and "our curious brother."—In the latter period of his life he settled as a physician at Bocking. He is the author of a "Pharmacologia," and of a History of Harwich,—both works of merit, and once of repute. See Pulteney's Sketches, vol. ii. p. 122-8. Pulteney says he was a F.R.S., but I do not find his name in the list of Fellows given by Dr. Thomson.

bone is roundish, and small at the ends, of a horny nature, inclining to leather." Specimens recent from the sea "are of a fine violet colour; but when we receive them, some are yellow, others white." *Ellis.* The claims of this species to be considered a British native are as doubtful as those of the preceding.

Fig. 36.

The Gorgonia Flabellum, *Lin.* (Fig. 36.) has been admitted into the British Fauna on very insufficient evidence. Dr. Borlasse tells us that, "the Flabellum veneris has been found on the shores of Mount's Bay after a storm, but whether from a wrecked vessel, or torn off by the violence of the waves from some rock in the Bay, is not to be asserted positively," (Cornw. 238.) "Most probably," says Mr. Couch, commenting on the passage, "it was foreign, for I have not heard of another specimen having been taken, and this was

dead when found (Corn. Faun. iii. 58). Professor Jameson says, that it was found on Leith shore, by the late Mr. Mackay; (Wern. Mem. i. 561.) and Dr. Neill, who saw the specimen, asserts "that it had all the aspect of being fresh and recent." (Flem. Brit. An. 511.) A fact communicated by Professor Edward Forbes, seems to account for this evidence of my friend Dr. Neill; he writes me:—"Mr. Goodsir has a large specimen of the Flabellum veneris dredged in the Forth. The fisherman who brought it, described it as being covered with living flesh when taken. On examination we found that it presented the curious appearance of West Indian incrusting shells and British mixed, and the living flesh was doubtless a British sponge, which had grown round the branches in many parts. This fully accounts for the story of its having been found fresh on the British shores."

20. Primnoa,* Lamouroux.

Character.—*Polypidom plantlike, irregularly branched; the axis horny, becoming very hard, continuous; polype-cells protruded far beyond the crust, subpedunculated and moveable, squamous, the aperture furnished with eight smaller testaceous scales.*

1. P. lepadifera, *scales of the polype-cells subquadrangular, four in the upper row; those of the aperture elliptical, entire.* R. Jameson.†

Resedæ similis maritima, *Raii* Hist. Pl. i. 68.—Gorgonia reseda, *Pall.* Elench. 204.—Gorgonia lepadifera, *Lin.* Syst. 1289. *Bast.* Opusc. Subs. ii. 130, tab. 13, fig. 1. *Ellis* and *Soland.* Zooph. 84, tab. 13, fig. 1, 2. *Jameson* in Wern. Mem. i. 560. *Stew.* Elem. ii. 430. *Lam.* An. s. Vert. 2de Edit ii. 507.—Primnoa lepadifera, *Lamour.* Corall. 223. *Flem.* Brit. Anim. 513. *Ehrenb.* Corall. 133. *Blainv.* Actinol. 510. pl. 87, fig. 6.

Hab. "Found on the coast of Aberdeenshire, and coasts of Shetland." *Jameson.*

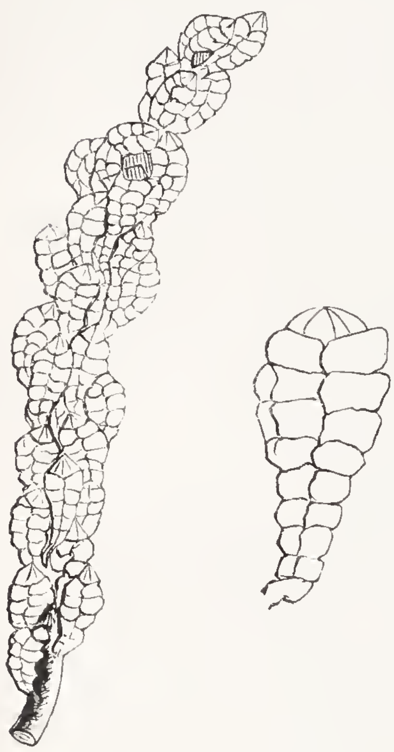
"This very curious animal rises usually to eighteen inches high." *Ellis.* It is irregularly branched, the stalk and branches of the same diameter, and about the thickness of a swan's quill. The axis is slender, cylindrical, and horny, very hard, and solid in the lower

* From πρυμνος an end, and ᾠὸν an egg.

† Regius Professor of Natural History in the University of Edinburgh, never mentioned without a mark of respect from one who has had the honour of being his pupil. Of this very distinguished and learned naturalist, there is a characteristic portrait in "Peter's Letters to his Kinsfolk," vol. i. p. 252.

parts, but softer and pithy towards the rounded extremities of the branches. The crust is whitish, and thickly covered with pearshaped scaly polype-cells, which project about four lines, and are mostly erect and appressed, but some of them are retroflexed; they are indistinctly carinate on the distal and concave on the proximal side, where the scales are imperfect. The scales are subimbricate, smooth, roundish, or inclined to be quadrangular, with an even or slightly broken margin, two in the lower series, four in the upper row; and here the polype-cell becomes suddenly truncate, a small cone rising up within, formed of eight lesser scales of an elliptical shape converging together. The polype-cell, as a whole, has been compared to the seed-capsule of the Reseda, whence the specific name which Pallas has adopted, and which has the right of priority; but Linnæus changed it to lepadifera, seeing a nearer resemblance to some species of barnacles: "Flores Lepadibus Balanis simillimi."

Fig. 37.



I have made this description from a fragment brought by Sir Arthur Capell de Brooke from Norway, and sent to me by Mr. Stokes. Ellis figures the polype-cells "hanging over one another;" and their pendulous condition is admitted into the generic character by Lamouroux, but it is evidently unessential, and dependant on the position in which the specimen has been dried. Mr. Stokes has just described, as I am informed by Professor Edw. Forbes, "a new species dredged by Sir James Ross, in more than two hundred fathoms' water, in the Antarctic seas:* it is very distinct from, but beautifully representative of the northern species, and it shews that the polype-cells are always nominally *erect*." This may be so, but it seems to me evident that, in the Pr. lepadifera, the animal has the power of moving the cells at will, and can hold them either erect or pendant.

Sir A. Capell de Brooke tells us that Primnoa lepadifera "is

* It will be figured in Sir James Ross's voyage. Mr. Stokes is the first to discover that specific characters in this genus depend greatly on the form and arrangement of the scales of the polype-cells.

found on the coasts of Norway, Lapland, and the White Sea, though it is considered rare by the inhabitants of these parts, who, when they accidentally meet with it, hang it up as a curiosity ;" or rather, as he informs us afterwards, because the fishermen suppose them to be a kind of charm, or protection against storms. Fishing for the uër, or red-fish, (Perca marina), which is found in the greatest plenty where the Sea-trees grow, the fisherman's line is often wound round their branches by the captured fish ; and the branch round which the line is fast, is often torn away and drawn to the surface. These Sea-trees " arrive at a very extraordinary size, if we may believe the accounts of the fishermen who have the most frequent opportunities of seeing them,—attaining dimensions even equal to those of our largest forest trees. This they conclude to be the case from their nets being sometimes entangled on the trunk or stem of the Gorgon, when the united strength of several men is unable to free the nets. At other times, a large portion of the animal has been pulled up with the net by main force, which they have represented as being of very considerable size ; and, from their description, without doubt a Gorgon.*

" They have even assured me that they grow to the height of fifty and sixty feet, as they judge from the following circumstance, which seems clear and simple. The lines for the red-fish are set, as I have said, in very deep water, at the distance of about six feet from the bottom, and in the parts where it is flat and level, which they can tell from their soundings. On drawing up the lines at the distance of forty, fifty, or sixty feet, and sometimes even more from the bottom, they get entangled with some of the upper parts or branches of the Gorgon, which are thus torn off; and hence they reasonably conclude that the animal rises to this height.

" In a particular part of the *fiord* near Carlsöe, Mr. Steer informed me, one of the Gorgons was growing, which he believed to equal in size many trees. The fishermen, he said, had repeatedly lost their nets and lines from their becoming entangled around the stem of it ; yet they were still induced to fish there, from the abundance of the red-fish they invariably found. Parts of the upper branches of this animal which had been brought to him by the fishermen, he presented me with, resembling in every respect the one here depicted." (Primnoa lepadifera.)

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* Perhaps these large trees may be rather referable to Alcyonium arboreum. G. J.

The Isis Hippuris, *Lin.* (Ellis and Soland. Zooph. 105, tab. 3, fig. 1-5.) is "said by the late Dr. Walker, to occur on the east coast of Scotland, and also in the Orkney Islands," *Jameson* in Wern. Mem. i. 560. No description of a British specimen has been published.

The Isis Entrochus of Turton (Brit. Faun. 206.) is a fossil species of Pentacrinus.

FAMILY—ALCYONIDÆ.

Les Alcyons, *Cuv.* Reg. Anim. iii. 320.—Polypi tubiferi, *Lam.* An. s. Vert. ii. 403.—Alcyonaria, *Blainv.* Man. 519.—Lobulariadæ, *Johnston* in Trans. Berw. Nat. Club, i. 107. *J. E. Gray* in Syn. Brit. Mus. 135.—Halcyonina, *Ehrenb.* Corall. 56.

21. Alcyonium,* Linnæus.

Character.—*Polype-mass lobed or incrusting, spongious, the skin coriaceous, marked with stellated pores ; interior gelatinous, netted with tubular fibres and perforated with longitudinal canals terminating in the polype-cells, which are subcutaneous and scattered.—Polypes exsertile.*

1. A. digitatum, *polymorphous, greyish-white or orange-coloured, the skin somewhat wrinkled, studded over with stellated pores even with the surface.* Dillenius.

Plate XXXIV.

Alcyonium ramosa-digitatum molle, astericis undiquaque ornatum. *Raii* Syn. 31, no. 2. *Breynius* in Ephemerid. Acad. Leopold. cent. 8, app. 159. *Bast.* Opus. Sub. i.

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* From *Alcyon*—the King's-fisher: the word itself signifies "sea-foam" of which the Halcyons were supposed to make their nests. See Lib. Entert. Knowl. "The Architecture of Birds ;" p. 45, &c.

"And every thing dispos'd it to my rest,
As on the seas when th' Halcyon builds her nest.
When those rough waves, which late with fury rush'd,
Slide smoothly on, and suddenly are hush'd ;
Nor Neptune lets his surges out so long,
As nature is in bringing forth her young."
Drayton's Heroical Epistles.

To the reasons adduced by Milne-Edwards for retaining the name Alcyonium to this group, I would add that *Lobularia* is inadmissible, having been pre-occupied by the botanists. The Alcyonium of Lamarck is composed of certain sponges, of which the true character remains unknown.

24, tab. 3. fig. 6, 7. *pessima*.—Main de mer, *Jussieu* in Mem. Acad. Roy. des. Sc. an. 1742, 294, tab. 9, fig. 1.—Dead Man's hand or Dead Man's toes, *Ellis* Corall. 83, no. 2, pl. 32, fig. *a*, *A*. *A*. 2.—Alcyonium manus marina, *Ellis* in Phil. Trans. liii. 431. tab. 20, fig. 10–13.—A. digitatum, *Lin.* Syst. 1294. *Mull.* Zool. Dan. prod. 255. *Fabric.* Faun. Grœnl. 447. *Ellis* and *Soland.* Zooph. 175, pl. 1, fig. 7. *Jameson* in Wern. Mem. i. 563. *Fleming* in Edin. Phil. Journ. ix. 251. *Cuv.* Reg. Anim. iii. 321. *Templeton* in Mag. Nat. Hist. ix. 470. *Harvey* in ibid. new series, i. 475, fig. 56. 57, (very inaccurate).—*Macgillivray* in Ann. and Mag. Nat. Hist. ix. 465. — *Couch* Zooph. Cornw. 27 : Corn. Faun. iii, 58. pl. 13, fig. 2. Alcyonium molle, *Esper* p. 56, tab. 18 B, fig. 1, 2. (This represents the species as it appears when it encrusts the tube of the Amphitrite.)—Alc. lobatum, *Pall.* Elench. 351. *Lamour.* Cor. Flex. 336, pl. 12, fig. 4, and pl. 13, fig. omn. Corall. 243, pl. 12, fig. 4 ; pl. 13, and pl. 14, fig. 1.—Lobularia digitata, *Lam.* Anim. s. Vert. ii. 413 : 2de edit. ii. 631. *Flem.* Brit. Anim. 515. *Grant* in Edin. Journ. of Science, no. 15. *Stark* Elem. ii. 421. *Johnston* in Trans. Newc. Soc. ii. 250, pl. 8. *Roget* Bridgw. Treat. i. 162, fig. 56. *Blainv.* Actinol. 521. *Ehrenb.* Corall. 57.

Var. β. orange-coloured.—Alcyonium cydonium, *Mull.* Zool. Dan. iii. p. 1, tab. 81, fig. 4, 5.—Lobularia conoidea, *Lam.* Anim. s. Vert. 2de edit. ii. 632. (exc. syn. plur.)—Cydonium Mulleri, *Couch* Zooph. Cornw. 28.

Hab. On stones, old shells, &c. in deep water.

This is one of our most common marine productions, so that, on many parts of the coast, scarce a shell or stone can be dredged from the deep that does not serve as a support to one or more specimens. It appears often in the form of a mere crust about the eighth of an inch in thickness, but more commonly it rises up in conoid masses of various sizes and lobed in a very irregular manner. Sometimes the polypidom is a simple obtuse process, very much resembling the teat of a cow's udder, whence our fishermen have happily named it *Cow's-paps :* other polypidoms are more or less divided into finger-like lobes, and assume figures that have suggested the names of *Dead Man's toes* or *Dead Man's hands.* The outer skin is tough and coriaceous, studded all over with stellate figures which, if attentively examined, are seen to be divided into eight rays, indicating the number of the tentacula of the polypes, which issue here. The body of the polypes is as it were enclosed in a transparent vesicular membrane, dotted with many minute calcareous grains, and marked with eight white longitudinal lines or septa which, stretching between the membrane and the central stomach, divide the intermediate space into an equal number of compartments. These lines not only extend to the base of the tentacula, but run across the oral disk, and terminate in the central mouth. The tentacula are short, obtuse, ciliated on the margins, and strengthened at their roots by numerous linear straight crystalline spicula. From the base of the white longitudinal lines an equal number of white tortuous glandular filaments de-

pend, hanging loose in an abdominal cavity placed underneath the fleshy cylindrical stomach, and continuous with the aquiferous canals.*

Fig. 38.

The Polype-cells are oval, placed just under the skin, and are the terminations of the long aquiferous canals which run through the whole polypidom. (Fig. 38.) These canals divide in their course into branches that diverge towards the circumference where they dilate into the cells; they have strong cartilaginous, perhaps muscular, coats; and are filled with a much less consistent matter than that of the body of the polype itself. It appears, from this disposition of the tubes, that many polypes communicate together and form a compound animal, but that all the polypes of the same polypidom do not communicate directly by their medium. The space between the tubes is occupied by a loose fibrous net-work, and the threads being a little more crowded at particular places, they form lozenge-shaped compartments within which are smaller meshes; and the interstices of the whole are filled with a transparent gelatine, in which numerous crystalline irregular spicula lie immersed. These spicula are mostly in the form of a cross and toothed on the sides, but they have no organic connection either with the reticular fibres or with the tubes; they are calcareous, for if a portion of the zoophyte is immersed in a mineral

* A classical friend on seeing the specimen from which our figure was taken in full expansion, when it is translucent and permits a view of the interanea, was reminded of the following lines:

> "In liquidis translucet aquis; ut eburnea si quis
> Signa tegat claro, vel candida lilia, vitro."
> "—————salientia viscera possis
> Et perlucentes numerare in pectore fibras."
>
> *Ovid.* Met. vi. 354 and 390.

acid, a strong effervescence immediately takes place, and spicula are no longer discernible.

The ova are placed in the polype-tubes ; they are white at first, but ultimately become of a scarlet colour, opake, globular, and about the size of a grain of sand. Each ovum is filled with a mass of extremely minute pellucid granules, and is ultimately discharged through the mouth. They seem to be produced in spring and summer, for in June and July, I have seen many specimens with not more than three or five polypes developed, which were as large and perfect as the polypes of the oldest specimens.

Dr. Fleming is of opinion, that the Alcyonium lobatum of Lamouroux, whose figure I have quoted without any mark of doubt, is a perfectly distinct species, because its tentacula "are sub-cylindrical, rounded at the extremity, and covered above and on the margin with blunt tubercles ;" whereas of the British Alcyonium "the tentacula in Ellis's figures (and, having compared these with nature, we can pronounce on their accuracy,) are pinnate and pointed." But of these figures of Ellis's, it may be observed, that the one he has given in his essay on Corallines* is very unlike the figure of the same parts in his Nat. Hist. of Zoophytes ; and I must acknowledge that neither of them correspond with what I have myself seen. When a specimen of Alcyonium digitatum is placed in a vessel of sea-water, the polypes protrude themselves amazingly, and extend their tentacula, which are thick, obtuse, grooved along the centre, and not longer than the diameter of the oral disk, being in fact very like what they are represented to be by Lamouroux ; but when these organs are removed and slightly pressed between plates of glass, they become so much elongated that I can readily believe they may, when the animal is active and in its native site, assume the shape and appearance of Ellis's latter figure. And I am thus drawn to the conclusion that the differences in the different figures will not justify the establishment of distinct species, but are to be attributed to the animal being in different states when observed,—a conclusion which a writer in the Encyclop. Method. Supp. p. 497, has also come to. "Les figures données par Ellis, Spix, et Lamouroux ne se ressemblent guére ; je pense neammoins que cette difference ne peut étre rapportée à aucune inexactitude, mais dépend de l'état du polype à l'instant ou il a été dessiné."

* This figure, it appears, was taken from specimens which had been immersed in spirits. Introd. to Corall. p. xii.

The LOBULARIA GRANDIFLORA of Chamisso, (*Ehrenb.* Corall. 57.) found in the English Channel, appears to me to be the same as Al. digitatum.

2. A. GLOMERATUM, "*polypidom massive, of no very defined outline; colour a deep uniform red, the shade of which approaches to vermilion.*" A. H. Hassall.

Alcyonidium rubrum, *Hassall* in Ann. Nat. Hist. vii. 285.—Alcyonidium glomeratum, *Hassall* in Ann. Nat. Hist. xi. 112.—Alcyonium sanguineum, *Couch* Corn. Faun. iii. 60, pl. 13, fig. 1.

Hab. Dublin Bay, *Hassall.* Coast of Cornwall, *Couch.*

"Of this species I have procured only a single specimen, and that not far from land: in general appearance it resembles the last species, the *Alcyonium digitatum,* but differs from it in several important particulars. Its surface is rather rough, coriaceous, and occupied by numerous spicula. The star-shaped depressions, which are numerous, are slightly depressed, yellow, and marked with eight rays. The cells, which are imbedded, are inversely conical and terminate inferiorly in long canals, which pass irregularly through the fleshy polype-mass, and opening into each other in all directions, give the substance the appearance of irregular net-work, the meshes of which are filled up with minute tubes, a gelatinous substance, and spicula. Thus the internal anatomy resembles that of the *Al. digitatum,* but is smaller and more delicate. The colour externally is of a deep blood colour, and internally is but slightly lighter. The lobes differ very considerably from those of the *Al. digitatum;* but as a specimen of that species was procured from the same locality, and at the same time, a comparison may be instituted between them. The protuberances in the *Al. digitatum* are, generally, not very numerous, do not divide low down, but arise from the sides and edges of the larger lobes, are always stout, somewhat compressed, and more closely resembling the teat of a cow than the human finger. In the present case, the lobes are very numerous, and divide nearly as low down as the base; they are elongated, cylindrical, and very nearly resemble the little finger both in shape and size. As the specimen was very nearly dead when I first saw it, the polypes can of course be but very imperfectly described. They seemed very similar in shape to those of the Al. digitatum, but were smaller and semi-opake; the tentacula were eight, fringed, and of a pinkish tinge, with a red band beneath encircling them; the various orifices could not be observed. The spicula are numerous and irregularly arranged; they

are linear-elongate, pointed at both extremities, with uneven or granular spaces between; sometimes they are simple, and at others united into K-shaped bodies, and occasionally wanting one or other of its members, forming an imperfect K.

"That this is not a variety of the Alcyonium digitatum seems almost certain. Having had opportunities of examining that species in many thousand instances, from all parts of the Cornish coast, from near the shore to mid-channel, and in all stages of growth, I may therefore be supposed to be familiar with it, yet on my own mind there is no doubt of its being distinct; and such also is the opinion of others who have examined it." *R. Q. Couch.*

22. Sarcodictyon,* E. Forbes.

Character.—*Polypidom incrusting, linear, creeping, anastomosing at intervals so as to form a sort of network. Polypes distant, in uniserial prominent cells, the tentacula eight and pinnated.*

1. S. catenata. E. Forbes.

Plate XXXIII. Fig. 4—7.

Hab. On rocks within low-water mark. Dredged in deep water at Youghal, *R. Ball.* Loch Fine, *Mr. MacAndrew.* It has been dredged by *Mr. MacAndrew* and *E. Forbes*, on the West coast of Scotland, in several localities.

In the dried state this interesting zoophyte forms a thin crust of a tile-red colour, creeping irregularly, generally in meandring lines, which are broken into a sort of chain, with the round nodulous polype-cells. These are perforated in the centre, and cut into eight sub-equal, and often indistinct, segments, which have converged and met, leaving sometimes a small aperture closed partially with a membrane. The fleshy crust contains spicula similar to those of Alcyonium. "The polypes are yellowish-white. They are extremely sluggish and shy in showing their tentacula, which are eight in number, whitish, of a granular tissue like those of Gorgonia, and solid. I kept many specimens alive for a week, and examined them every day, but could never convince myself they were other than Asteroid polypes, closely allied to Alcyonium." *E. Forbes.*

Professor Forbes finds that the polypes in the Pennatulidæ are

* From σαρκὸς, flesh; and δίκτυον, net-work.

developed in a spiral arrangement, and he thinks the same law will be found to regulate the position of the polypes of the Alcyonium; but in Sarcodictyon they are produced in a linear series, and they are, at all events, evidently more individualized; hence the propriety of raising it to the rank of a genus, notwithstanding the similarity of structure between it and the Alcyonium and Sympodium.

I cannot distinguish dried specimens from those sent me for Zoanthus Couchii, and hence I may have named some of the Sarcodictyon erroneously, sent me by various correspondents. This is the case, I suspect, with those from my friend Mr. W. Thompson, and published under the name of Zoanthus in his report on the invertebrate Fauna of Ireland. Rep. of Brit. Assoc. 1843, p. 284. See also Ann. N. Hist. xiii. 440: Forbes in Ibid. xiv. 415.

The Cydonium Mulleri of Fleming is a member of the class of Sponges. See my History of British Sponges and Lithophytes, p. 195.

The fossil Asteroida are few, and comparatively uninteresting. Remains of Pennatulæ have been found in the Lower Chalks; and Mr. Morris mentions nine species of Gorgonia, none of which are identical with recent species. They appear in the Silurian system, and are found in the Magnesian and Carboniferous Limestone, and in the Lower Chalks. The Ventriculites of the chalks are considered by Dr. Mantell to have been analogous to the Alcyonia (Medals of Creation, i. p. 275), but in Mr. Morris' Catalogue they are enumerated amongst the Sponges.

ANTHOZOA HELIANTHOIDA.

ZOANTHA, *Blainv.* Man. 308.—ZOOCORALLIA POLYACTINIA, *Ehrenb.* Corall. 31.—Les ZOANTAIRES, *Audouin* and *M. Edwards* in Lam. Anim. s. Vert. ii. 106.—ZOOPHYTA HELIANTHOIDA, *Johnston* in Mag. Zool. and Bot. i. 448.—ZOANTHARIA, *J. E. Gray* in Syn. Brit. Mus. 129.

Fig. 39.

I borrow the name of this order from Latreille, but give to it a wider application than it has in the classification of that illustrious naturalist, that it may embrace the madrepores and starred stones, which the observations of Le Sueur, confirmed as they have been by subsequent voyagers, demonstrate to be the products of zoophytes similar, in all essential points, to the naked Actiniæ. The order thus corresponds to the class "Zoantha" of De Blainville,—a name which has the claim of priority, and might have been adopted by me, were it not rather of classical, than ordinal value, and, because its conjunction with Anthozoa appeared inappropriate, as involving a tautology. The term preferred expresses the resemblance which the animals it designates have to the compound or syngenesious flowers,—a resemblance which has been very gene-

rally remarked, and the source of the name—*Sea Anemonies* —by which the typical species are known in this country. When speaking of these Ellis says,—"their tentacles, being disposed in regular circles, and tinged with a variety of bright lively colours, very nearly represent the beautiful petals of some of our most elegantly fringed and radiated flowers, such as the Carnation, Marygold, and Anemone." The language of Le Sueur in respect of the tropical coral-bearing tribes is still warmer. The little polypes of Porites astroïdes, when in blow, remind him of a field enamelled with small flowers; and of them in general he says,—"Quand la mer est calme, c'est un spectacle admirable que de voir les belles couleurs veloutées qu'ils étalent : elles imitent les tapis les plus riches et les plus variés. Près d'eux se montrent des gorgones et des serpules dont les houpes blanches, jaunes et rouges, brillent de l'éclat le plus vif, et des amphitrites qui élèvent au-dessus de l'eau leur tête couronnée de palmes enrichies des teintes les plus variées. Je ne pouvois me lasser d'admirer avec quelle profusion ces animaux sont groupés et enlacés: c'étoit à regret qu'après m'être promené long-temps au milieu d'eux je me déterminois à les arracher du sein des eaux, et à en mettre des fragments dans un baquet, que je faisois de suite transporter chez moi pour examiner a loisir les animaux particuliers à chacun des polypiers." *—It is only, however, when they lie with their upper disk expanded and their tentacula displayed, that they solicit comparison with the boasts of Flora, for when contracted the polypes of the madrepores conceal themselves in their calcareous cups, and the Actiniæ hide their beauty, assuming the shape of an obtuse cone or hemis-

* Memoires du Muséum, tom. vi. p. 272 and 287.—Ehrenberg "was so struck with the magnificent spectacle presented by the living polyparia in the Red Sea, that he exclaimed with enthusiasm, 'Where is the paradise of flowers that can rival in variety and beauty these living wonders of the ocean?'" Mantell's Wonders of Geology, p. 486.—"There are few things more beautiful to look at than these corallines when viewed through two or three fathoms of clear and still water. It is hardly an exaggeration to assert, that the colours of the rainbow are put to shame on a bright sunny day, by what meets the view on looking into the sea in those fairy regions." Captain B. Hall's Fragments of Voyages and Travels, vol. i. p. 115.—For an illustration of the impression which our own Sea-Anemonies may make on a man of observation and genius, see Southey's "Poetical Works," (Edit. in 1 vol. Lond. 1845), Pref. p. ix.; Thalaba, bk. xii. p. 308 ; and Kehama, xvi. p. 604.

phere of a fleshy consistence, or elongating themselves into a sort of flabby cylinder that indicates a state of relaxation and indolent repose.

The Actinia coriacea is the principal species which the anatomist has examined with care,* and it may safely be chosen as the representative of its order, the probability being that the deviations from its structure in the other species and genera are only of secondary consequence. Of the species mentioned Mr. Teale has given a very elaborate anatomy,† more correct and minute than any hitherto published, but the sketch to suit our design, must be of a more general character.

The body of the Helianthoïda may be compared to a truncated cone or short cylinder, seated on a flat plain base, while the opposite end is dimpled in the centre with the oral aperture, and garnished with variously figured tentacula which originate from a space (*peristome*) between the proper lip and the free somewhat thickened border of the disk. In a state of contraction the mouth is closed, the tentacula are shortened, and the whole concealed by this border, being drawn like a curtain over them, leaving a mere depression on the top. The mouth leads by a very short and wide passage into a large stomach, which is a membranous bag puckered internally with numerous plaits, and divided in a perpendicular direction into two equal halves, by a deep smooth furrow with cartilaginous sides, as was first remarked by Reaumur.‡ There is no intestine, nor any other visible exit from the stomach than the mouth, by which the undigested remains of the food are ejected, always enveloped in a large quantity of a clear glairy fluid. But in a state of expansion and of hunger, many kinds

* M. Delle Chiaje has, it seems, anatomized several other species, but I cannot read his work, which is written in the Italian language. For a similar reason I have not been able fully to avail myself of the writings of German naturalists.

† "On the Anatomy of Actinia Coriacea, by Thomas Pridgin Teale," in Transactions of the Leeds Philosophical and Literary Society, vol. i.

‡ "They (the furrows) are produced on each side by the firm adherence of the gastric membrane to a pair of very dense, fleshy, but narrow leaflets, throughout their whole extent, or, in other words, from the top to the bottom of their internal border. These depressions divide the animal into two lateral halves, constituting a bilateral symmetry in Actinia, as has been observed by M. Agassiz in other supposed radiated animals." Teale in loc. cit. 102.—But in Actinia plumosa the channel or furrow exists on one side only.

of Helianthoïda can protrude the stomach beyond the lip in the form of large bladder-like lobes, which often hang over the sides and almost conceal the rest of the body ; and amidst them there are very frequently extruded at the same time some white filaments, like bundles of ravelled thread, which have escaped through a circular opening in the bottom of the stomachal membrane. The space between the walls of this organ and the outer envelope is divided into numerous narrow compartments by perpendicular and parallel lamellæ of a musculo-tendinous texture, which extend from the oral disk to the base, and radiate to the centre like the gills of a mushroom to its stalk.—a comparison the more exact as some only of the lamellæ reach and touch the stomach, the rest coming more or less short, and forming consequently imperfect interseptal spaces. "The breadth of the leaflets varies considerably, some extending scarcely a line from their external attachment, others reaching as far as the stomach, being nearly half an inch in breadth. The height generally corresponds with the height of the animal ; a few, however, of the narrowest leaflets extending upwards from the base, terminate obliquely in the sides, without being prolonged as high as to the lip or roof."* These lamellæ are of a muscular character, and by their actions cause the body to assume its various forms. The spaces between them are filled 1*st*, with the ovaries attached, in elongated masses, to the inner border of most of the leaflets ; and 2*dly*, with the "vermiform filaments" which, as already mentioned, are often extruded at the mouth. These filaments are capillary, greatly convoluted, smooth and of a white colour, with a sort of mesentery extended along one side. Their appearance naturally suggests the idea of their being either the intestines or the oviducts of the creature ; and they have been often described as ovarian, even by late authors,† but Mr. Teale has fully shewn the erroneousness

* Teale in Trans. Leeds' Soc. i. 96.

† "Entre ce sac intérieur (the stomach) et la peau extérieure, est une organisation assez compliquée, mais encore obscure, consistant surtout en feuillets verticaux et fibreux, auxquels adhèrent les ovaires, semblables à des fils tres entortillés." Cuvier, Reg. Anim. iii. p. 290. Delle Chiaje in Bull. des Sc. Nat. xvii. 471. See also J. R. Jones in Cyclop. of Anat. and Physiol. ii. 409.—Sharpey describes them as oviducts. Cyclop. cit. i. 614. Dicquemare had a singular notion that they

of this opinion. It appears in fact that they are male organs for the secretion of the seminal fluids, Professor Wagner having discovered spermatic animalcules in them.* They are undoubtedly tubular, although Mr. Teale acknowledges that he has not been able to obtain any evidence of the fact, and "under the microscope it appears simply as a round, solid, translucent chord." Such also has it always appeared to me, so that I can scarcely hesitate to pronounce Dicquemare's description of its structure to be incorrect. "I have observed," he says, "that there grows or comes out of their body and mouth a sort of threads about the size of a horse-hair, which, being examined with a solar microscope of five inches diameter, appear as if made up of a prodigious number of vessels, wherein a liquor is seen to circulate. The largest of these unite together, much in the same manner as the optic nerves do in man."†

The external envelope of the naked Hydroïda is a thick firm fleshy or coriaceous skin consisting of a corium and epidermis, —the former layer constituting the chief organ of support, and giving to the animal its peculiar form. "A circular horizontal portion forms the base or foot; a cylindrical vertical portion constitutes the sides, and is inflected at the superior border, so as to form a thick rounded lip. The corium is afterwards prolonged over the tentacula, giving investment and form to these organs, and is then extended horizontally to form the roof, near the centre of which it again becomes folded upon itself, forming an internal lip or mouth, at which part it is continuous with the digestive sac."‡—"The epidermis forms a thin layer of unorganized matter spread over the whole extent of the corium, and may be traced into the stomach. The external surface of the epidermis is dense and membranous; internally, when examined by the lens, it ap-

contained certain bulbs, or buds, "which open in time, and cleaving to the bodies on which these threads are extended, produce small anemonies." Phil. Trans. abridg. xiii. 639.

* Ann. des Sc. Nat. viii. 283. Professor Owen attributes to them the same function, Lect. p. 87; and The Lancet, No. 871, p. 225. I know not how to reconcile the fact with some statements in the volume of "Reports" published by the Ray Society, p. 381 (1845). Erdl is convinced that the sexes are separate.

† Phil. Trans. abridg. xiii. 639.

‡ Teale in lib. supra cit. 93.

pears as a pulpy substance. Intimately intermixed with it, in irregular patches, and not constituting a distinct or separate layer, is a pigment varying in colour in different parts of the same animal, and in different individuals. This colouring matter is extensively distributed over the base, sides, tentacula, and roof, but I have never observed any trace of it in the stomach."* The surface is either smooth or studded over with porous warts, which, having an adhesive quality, enable the creatures the more completely to conceal themselves by induing the body with an extraneous coat formed of the sand, gravel, and broken shells which lie around their peculiar localities. This is exchanged in the madrecolous tribes for the more perfect defence which a hard coral affords, into which the soft parts are withdrawn at will. "This coral is calcareous, and the cells which are inhabited by the animals are furnished with more or less distinct longitudinal lamellæ, placed in a radiating position round the central axis, so as to give the cavity a star-like appearance."† Its structure is in fact a model cast in lime of what may be called the skeleton of the Actiniæ, — the parts on which the support depends being converted into stone by a deposition of calcareous matter in their texture,—the corium in this manner becoming a solid polypidom, and the muscular leaflets partitions of limestone.‡

When a Helianthoid Polype is at rest and unalarmed, it can dilate the body to fully twice its ordinary bulk by imbibing water through the mouth or tentacula,§ the bases of which

* Teale in loc. 95. † Gray in Synop. of British Museum, 70.

‡ "Dans cette classe d'animaux, le polypier ou la partie solide qui reste quand le partie animale a été desséchée et enlevée, est donc une sorte de réseau calcaire d'un tissu plus ou moins compacte, qui remplissoit les mailles, les vacuoles de celle-ci. La proportion de ces deux parties est en rapport avec l'âge da zoanthaire : plus il est jeune, plus il y a de matière animale ; plus il est âgé, et plus il y a de matière inorganique : aussi la base de ces polypiers, le plus souvent morte, est-elle fort dure, tandis que le sommet ou les bords essentiellement vivans sont entièrement mous." Blainville, Actinolog. 311.—See also Harvey in Mag. Nat. Hist. n. s. i. 474.

§ "It has not, so far as I know, been clearly shewn by which of the communicating orifices the water enters. Though I took considerable pains, I have not been able satisfactorily to ascertain this point. I may remark, however, that I have repeatedly noticed water entering at the mouth." Sharpey in Cyclop. Anat. and Phys. i. 614.—Delle Chiaje asserts that it enters by the tentacula. Bull. des Sc. Nat. xvii. 471. He adds, "Il est curieux d'observer le courant d'eau qui, lorsque

open in the spaces between the perpendicular lamellæ. These spaces being filled, the water is then made to permeate the rim of the oral disk, which is full of cavities and cells for its reception; and the tentacula are in the same manner distended, the water being forced into them from behind while the little opening on their tips is held close. The whole animal is thus distended to a wonderful degree, and every organ stretched and displayed;—the tentacula spread out in quest of prey,—the skin rendered almost clear from very fulness; and the stomach, pushed beyond its natural bounds, often lies over the sides in swollen diaphanous lobes. The water thus introduced is doubtless subservient to the purposes of respiration; and to aid this, the vermiform filaments, and the internal surface of the stomach and tentacula are clothed with vibratile cilia, exciting and directing currents over the surfaces.* Since too the contents of the stomach must be fully exposed to the influence of the water, the nutrient parts may be by its means fitted for more immediate assimilation, for as there is neither circulating nor lymphatic systems, the absorption of the nutrient fluids must be made directly from the stomach itself. By the contraction of the periphery of the body, this water is again expelled at pleasure through the tentacula in a continuous stream or in jets, and if the contraction is sudden and strong, the water may be thrown out with such force as to rise to the height of at least a foot. It is remarkable that the water does not escape from all or the greater number, but only from a few of the tentacula. Whether any part escapes by the mouth has been doubted, but I have seen it ooze thence too often to join in the doubt. The water, too, in the Actinia crassicornis and its allies, is often ejected in a small stream from the perforated tubercles of their skin, and with such a degree of force that the jet will rise to a height of not less than four inches.

l'Actinie se relâche, pénètre par quelques tentacules, et dès qu'elle se contracte, sort par d'autres tentacules précisément opposés aux premiers. Ce phénomène s'observe sur toutes les espèces d'Actinies."

* Sharpey in lib. cit. i. 614-15.—There is a distinct circulation within the tube of the tentacula, unconnected apparently with any circulation within the body. A current may often be seen, even with a common magnifier, setting up towards the apex, where it is turned and sets in the contrary direction; but before the stream has reached the base, it again has turned, and retakes its centrifugal direction.

The Helianthoida are all animal feeders, and the principal use of the tentacula seems to be to catch the errant prey and convey it to the mouth. To disable the animal, and render its struggles for escape unavailing, the class is furnished with poison-vesicles and spicula similar to those which we have already described as existing in the tentacula of the Hydra. These organs were first discovered, I believe, by M. Quatrefages, but they have been described also by Wagner and Erdl.* They are little elliptical capsules furnished with a projecting spiculum, situated under the skin, sometimes scattered over the whole body, and in other species confined apparently to the tentacula, or even their tips, as in the genus Corynactis. The poison secreted by them is very variable in its power: in many species the sensation produced by handling them can scarcely be said to be unpleasant, but in others it is smart and pungent. We must take our illustrations from British species only.† I have often handled our commoner Actiniæ without experiencing more than a slight heat in the fingers, scarcely sufficient to draw attention; but in the Antheæ, which have non-retractile tentacula, and in whom the power of adduction is consequently weak, the activity of the poison is heightened. In reference to Anthea cereus, Rondeletius says, "Veritablement est Ortie, car si vous la manies, elle pique fort." Rapp again says that the stinging is only felt on places where the skin is thin, and scarcely in the fingers, which is contrary to the experience of Mr. Cocks, and of my friend Mr. Embleton, who has been stung with Anthea Tuediæ. Mr. Cocks further writes, "The fish that has been so unfortunate as to be embraced by the tentacula of the Anthea cereus, for a few minutes, loses its activity, becomes stupid, the eyes injected, and death soon closes the scene. In August, 1845, I removed from the stomach of an individual a partially digested fish, nearly four inches in length; and I have frequently taken from the stomachs of others, crabs two and a quarter inches in diameter."

The native species, with the sole exception of Zoanthus, are

* See the Microscopic Journal, ii. p. 73; and Reports on the Progress of Zoology printed by the Ray Society (1845), p. 381.

† For instances of urticating Corals, see Darwin's Voyages round the World, p. 464. Duod. edit.

single, viz. every individual is isolated and complete in itself, and not organically associated with others, as the polypes of the preceding orders are. They are also all oviparous, the ova being generated in appropriated organs. According to Spix, the ova, in the Actiniæ, form several grape-like clusters, situated in the interseptal spaces, with ducts which open into the base of the stomach by several apertures, and hence the ova are presumed to gain their freedom by traversing the stomach and mouth.* Blainville doubts this, being led from analogy to believe it more probable that the oviducts may open in the labial rim, as they do in the asteroid zoophytes.† Delle Chiaje says that they terminate in the tentacula of the Actiniæ;‡ and Cavolini states, that in the Caryophyllia the ova are discharged through small distinct openings between each of the tentacula.§ Their natural passage of egress may be considered to be undetermined, but it seems to be ascertained that they do, under certain circumstances, escape from the body sometimes through the tentacula, or in apertures between them, and sometimes through the mouth. Mr. Teale, after vainly attempting to discover any proper oviduct, thinks it probable that the ova, when sufficiently matured, "actually burst their membranous envelope, and become lodged in the interseptal spaces where they are exposed to the free access and continued supplies of sea water, the grand stimulus to their further development."¶ The supposition readily explains certain facts which have given rise to an opinion of their viviparous generation, for the young will be born alive if the easy admission is made that some of the ova may have their egress delayed until they have passed through their first stages of evolution. That many ova, and probably by much the greater number, escape previously to this is now well ascertained.

Mr. Teale's description of the ovaries differs also from Spix's, and is very accurate. In Actinia coriacea he tells us they form "elongated masses attached along the inner border

* Carus, Comp. Anat. Trans. ii. 308, pl. i. fig. x.

† Man. d'Actinologie, 79.

‡ Bull. des Sc. Nat. xvii. 471.

§ Edin. New Phil. Journ. i. 153.

¶ Leeds Phil. and Lit. Soc. Trans. i. 111. Couch's Corn. Faun. iii. p. 68—9.

of most of the leaflets. Each ovary is composed of several horizontal folds or plaits, which, when unfolded, show this structure to be about three times the length it assumes when attached to the leaflet. By carefully spreading out these folds, the ovary, with the assistance of a lens, is seen to consist of two very delicate layers of membrane, enveloping a closely compacted layer of ova. After enveloping the ova, the membranous layers are placed in apposition, and form a kind of mesentery, by which the ovary is attached to the internal border of the leaflet. The two layers afterwards separate to pass one on each side of the leaflet, thereby lining the interseptal spaces from which this membranous investment is prolonged into the tentacula, as well as into the cavities within the structure of the lip and mouth. At the summits of the tentacula, and of the tubular eminences of the lip, the membrane becomes continuous with the common integument, whilst at the inferior part of the interseptal spaces it is continuous with the digestive sac. The breadth of the ovaries is nearly uniform from the top to the bottom. Some irregularities are occasionally observed in their attachment to the leaflets. Sometimes one leaflet supports two ovaries, and not unfrequently two neighbouring ovaries are continuous with each other at their inferior extremities."*

The period of propagation is probably, in most Helianthoïda, not limited to any particular season. According to the observations of Cavolini, the Caryophyllia matures its ova in spring; and it is only at this season that I have found the Lucernariæ on our northern shores, when they are big with numerous eggs. But in the Actiniæ, ova in every state of developement may be seen in the same individual throughout the year; perhaps, however, they are most abundantly laid in autumn. They are usually of a roundish figure, and, like the gemmules of polypes in general, contractile and motive, being carried about from the action of the cilia that clothe the surface. "Under the microscope they prove of diversified form, many resembling flattened pease, some elongated or exhibiting irregular prominences, some almost spherical, others as if composed of two or even of three unequal spheres, and some which cannot be

* Lib. supra cit. p. 104.

referred to any particular figure." After moving about for several days, during which their forms suffer some slight change, they insensibly relax in their activity, the cilia disappear, and, having become stationary, each rapidly runs through the stages of development that lead it up to the similitude of its parent.

Every one has read of the coral islands of tropical seas; how they grow from the fathomless profound, and how they rise to day by the operations of puny insects, which in countless numbers, and in untold generations, effectuate changes on our globe superior, perhaps, to what all other animals united do, and compared to which the greatest achievements of "intellectual man," sink to insignificance.* Geology teaches us that with these worms the great work of creation began; and from that uncertain date even to the present day, their amazing labours have been continued, the product remaining in the extensive ranges of limestone rocks which lie buried in our northern regions, as well as in those islands of new formation with which they threaten to convert the equatorial seas into dry land. "They that sail on the sea tell of the danger thereof; and when we hear it with our ears we marvel thereat."†

> "Millions of millions thus, from age to age,
> With simplest skill, and toil unwearyable,

* "Their plants are made of stone, and they build dwellings. Dwellings;—they construct islands and continents for the habitation of man. The labours of a worm, which man can barely see, form mountains like the Apennines, and regions to which Britain is as nothing. The invisible, insensible toil, of an ephemeral point, conspiring with others in one great design, working unseen, unheard, but for ever guided by one volition—by that One Volition which cannot err—converts the liquid water into the solid rock, the deep ocean into dry land, and extends the dominions of man, who sees it not and knows it not, over regions which even his ships had scarcely traversed. This is the Great Pacific Ocean; destined, at some future day, to be a world! That same power which has thus wrought by means which blind man would have despised as inadequate, by means which he has but just discovered, here too shows the versatility, the contrast of its resources. In one hour it lets loose the raging engines, not of its wrath, but of its benevolence; and the volcano and the earthquake lift up to the clouds, the prop and foundation of new worlds, that from those clouds they may draw down the sources of the river, the waters of fertility and plenty." *Dr. Macculloch*, Highlands and West. Islands, vol. iv. p. 14.

† Ecclesiast. chap. xliii. v. 24.

No moment and no movement unimproved,
Laid line on line, on terrace terrace spread,
To swell the heightening, brightening gradual mound,
By marvellous structure climbing tow'rd the day.
Each wrought alone, yet all together wrought,
Unconscious, not unworthy instruments,
By which a hand invisible was rearing
A new creation in the secret deep.
Omnipotence wrought in them, with them, by them ;
Hence what Omnipotence alone could do
Worms did. I saw the living pile ascend,
The mausoleum of its architects,
Still dying upwards as their labours closed :
Slime the material, but the slime was turn'd
To adamant, by their petrific touch ;
Frail were their frames, ephemeral their lives,
Their masonry imperishable."*

By much the greater number of those wonder-working zoophytes belong to this order. In former ages the geologist tells us that they were numerous and varied in our seas,—their remains, entombed in limestone and marble, constituting the models by which he decyphers their forms and species ; but this ancient host is now represented by two or three species only, and these so small and rare, that it would be giving them a disproportionate importance to make them more than the subject of a passing allusion to the labours of their races.

* Montgomery's Pelican Island, canto ii. p. 27.

" The turf looks green where the breakers rolled,
O'er the whirlpool ripens the rind of gold,
The sea-snatch'd isle is the home of men,
And mountains exult where the wave hath been."

On the formation of coral islands, see Darwin's Journal, iii. p. 547—569. Professor Owen has given a summary of Darwin's observations and views in his Lectures, p. 89—93.

Fig. 40.

The British species may be arranged under the following families and genera:

SECT. I.—Body secreting a calcareous polypidom. CORALS.

* Coral cellular throughout. MILLEPORINA, Ehrenberg. (Les Madrépores, *Blainville.* Lithophyta porosa, *Schweigger.*)

Cells substellate with porous interspaces. POCILLOPORA.

* * Coral with terminal cells. OCELLINA, Ehrenberg. (Madrephylliæa, *Blainville.* Lithophyta lamellosa, *Schweigger.* Madreporidæ, *J. E. Gray.*)

Coral free, the base pointed . . TURBINOLIA.
Coral fixed, the base expanded . CARYOPHYLLIA.

SECT II.—Body coriaceous or fleshy.

* Polypes associated by a common base. (Gemmiparous.) ZOANTHINA, Ehrenberg.

Base root-like, creeping . . . ZOANTHUS.

* * Polypes separate and single. (Ovo-viviparous.) ACTININA, Ehrenberg.

Tentacula in uninterrupted circles. ACTINIADÆ.

† Tentacula imperforate.

Body invested in a lobed epidermis . CAPNEA.
Epidermis normal . . . . . CORYNACTIS.

† † Tentacula tubular, retractile.

Base broad, the animal immoveable . ADAMSIA.
Base broad, the animal locomotive . ACTINIA.
Base narrow, the animal unfixed . ILUANTHOS.

† † † Tentacula tubular, not retractile . . ANTHEA.

Tentacula in tufts, at distant intervals. LUCERNARIADÆ.

One genus only . . . . . LUCERNARIA.

ANTHOZOA HELIANTHOIDA.

I. MILLEPORINA.

Ehrenberg, *Corall. des roth. Meeres*, p. 122.

Fig. 41.

23. Pocillopora,* Lamarck.

Character.—*Polypidom calcareous, fixed, plant-like, branched or lobed: Cells scattered over the whole surface, distinct, sunk in little fosses, obscurely stellate, the lamellæ narrow and almost obsolete.*

1. P. interstincta, "*cylindrical, with distant immersed stars.*" Dr. Hibbert.†

Madrepora interstincta, composita stellis immersis teretibus distantibus interstitio punctato, *Mull.* Zool. Dan. prod. 252.—Pocillopora interstincta, *Flem.* Br. Anim. 511.

Hab. "A specimen, probably of this species, which I have seen, was obtained by Dr. Hibbert, in Zetland," *Fleming.*

The Madrepora interstincta of Linnæus, probably synonymous with the Pocillopora cærulea of Lamarck, is a production of the Indian ocean, and it is reasonable to hesitate before we admit it amongst the natives of the Zetland sea. There may be an error in

* From *pocillum*, a little cup, and *porus*, a pore.

† Samuel Hibbert, M.D., the author of a "Description of the Shetland Islands," 4to. Edin. 1822; and of many geological essays in our Journals and Transactions. To commemorate his services in fossil ichthyology, Agassiz has given the name *Hibbertii* to two or three species of fish.

the identity of the species, for Dr. Fleming speaks doubtfully—"probably of this species,"—but I cannot believe that the Pocillopora indicated by him is in fact the *Oculina prolifera* of Lamarck, as has been conjectured, for here there is a difference in genus; and Müller, the last author to give one species under two names, enumerates both a Madrepora interstincta, and a M. prolifera in his catalogue of the animals of Denmark and Norway.

However, there is reason to believe that the Oculina prolifera * is also a Zetland animal. Professor Edward Forbes informs me that the figures of this coral in Ellis's Zoophytes, and in Esper's book, recall to his mind a very large specimen in the possession of Dr. Edmonstone, of Orkney. Until we have more specific information, I rest satisfied with this indication of a native locality for the Oculina, for a more formal introduction of it into the British Fauna would be yet scarcely justifiable.

II. OCELLINA.

Ehrenberg, *Corall. des roth. Meeres*, p. 75.

24. Turbinolia,* Lamarck.

Character.—*Animal like the Actinia, single: Polypidom simple, inversely conical, furrowed on the outside, pointed at the base, and terminated above in a lamellated cup or cell.*

1. T. borealis, "*widely conical, slightly bent.*" Rev. Dr. Fleming.†

Fungia turbinata, *Fleming* in Wern. Mem. ii. 250.—Turbinolia borealis, *Flem.* Brit. Anim. 509.

Hab. "Zetland," *Fleming.*

"This species occurred in the same boat in which I picked up the Caryophyllea cyathus. Though greatly defaced, it still exhibits

* Madrepora prolifera, *Pall.* Elench. 307. *Lin.* Syst. 1281. *Mull.* Zool. Dan. prod. 252. *Ellis* and *Soland.* Zooph. 153, tab. 32, fig. 2.—Oculina prolifera, *Lam.* An. s. Vert. ii. 286: 2de édit. ii. 456. *Blainv.* Actinol. 380. *Ehrenb.* Corall. 80.

* From *turbo*, a top.

† The author of the "Philosophy of Zoology," and the "History of British Animals." He, for many years, discharged the duties of a minister of the Church of Scotland; and was afterwards Professor of Natural Philosophy in King's College, Aberdeen. He is now Professor of Natural Science in the College of the Free Church of Scotland. To his labours and writings, scarcely estimated yet at their just value, I am inclined to ascribe a very considerable share in diffusing that taste for natural history which is now abroad.

proofs of its *recent* origin. It is inversely conical, pointed, subarcuated, with a concave disc and a prominent centre; the plates appear to have been equal. It is about five-tenths of an inch in height, and nearly the same in breadth across the star." *Fleming.*

This description will scarcely enable us to identify the species. Professor E. Forbes has no doubt that it is identical with Caryophyllia Smithii, and he has sent me a specimen, dredged in the Zetland seas, which seems to confirm his view. I give a figure of it. (No. 42.) The specimen is a dead one, and the lamellæ are considerably decayed, but it undoubtedly belongs to our existing Caryophyllia, the turbinated shape being the result of age, and produced by a process of absorption yet little understood. For it is now certain that the Turbinoliæ are rooted in their first and early stages of existence, but, as age creeps upon them, the body of the fleshy polype is raised higher by a deposition underneath it of calcareous matter, and the basal portion of the coral, no longer required to contain the tenant, has its breadth diminished in proportion to the other's gradual rise, until the attenuation at the lowest point comes to be merely a weak neck, which easily breaks away, and leaves the Zoophyte "detached," or at freedom. The most singular fact is that the absorbent process should go on only in that portion of the coral which has ceased to have any immediate connection with the soft parts of the animal, and have in fact become, as it were, extraneous to it; and moreover, it proceeds from without inwards. Attrition will not explain the result, but I have sometimes imagined that it might be the effect of the corrosion of the acrid fluid that exudes from the skin and stomach of these creatures.

Fig. 42.

2. T. MILLETIANA, *wedge-shaped, compressed, grooved, with twenty-four longitudinal smooth ribs.* Mr. MacAndrew.

PLATE XXXV. FIG. 1—3.

Turbinolia milletiana, *Lam.* Anim. s. Vert. 2de edit. ii. 364. *S. V. Wood* in Ann. and Mag. N. Hist. xiii. 12. *Morris* Cat. 46.

Hab. Dredged off Scilly, coast of Cornwall, by *Mr. MacAndrew.* Dredged off the Isle of Arran, on the west coast of Ireland, *Mr. Barlee.*

Coral white, turbinate or wedge-shaped, somewhat compressed,

strongly grooved in a longitudinal direction, the interspaces or ribs equidistant, smooth, glossy, broader than the furrows, converging towards the narrow base, where some unite, and others are continued to the very point, if not in a slight degree beyond it. Above, the ribs turn over the edge, and are continued into the centre of the enlarged oval cup, forming its lamellæ. These are twenty-four in number, alternately longer and shorter, arched, and crenated on the inner margin; and in the centre of the disc or cup there is a transverse lamella, which some of the concentric lamellæ are long enough to touch.

That the Zoophyte must have lived for some time after having become a moveable thing is proved by the ribs being continued beyond or around the point of attachment.

The specimen which has afforded our description, is five lines in height, and three in the diameter of its top. It was dredged alive by Mr. MacAndrew, and lent me by Professor Forbes, who truly remarks, that it is "a most interesting and beautiful species, the more so as it is certainly identical with Defrance's Turbinolia milletiana, found in both the crags." An examination of fossil specimens from Mr. Wood and Professor Forbes, has left me assured of the accuracy of this conclusion; and the fact assumes great interest as an additional illustration of the permanency of species in general. 'Tis a long time since the "coralline crag" was deposited,—long enough methinks for any good law to develope its effects in its subjects,—and yet this very old Turbinolia has not obeyed the "law of development," but has steadily maintained, amid the changes around it of very many centuries, its original features, and form, and size, alike careless of human theorems, and insensible to the urgency of its innate appetencies and higher aspirations! I can perceive no difference between the Turbinolia of the crag, and the Turbinolia now living off Scilly, except that the base of the former is less pointed; and this trivial difference would probably disappear in an examination of a larger series of specimens. I have now seen three recent examples, and they all differ a little in the width of the base. In one fossil specimen, the ribs were undulated on the lower half of the polypidom, the projection of the one rib running into the recessions or bays of the other next it, but this character is inconstant.

"Michelin, in his 'Polypiers fossiles de France,' figures a species under the name of '*Turbinolia mixta*, Defrance MS.,' (pl. 43, fig. 3), from the Paris basin, which is evidently identical with the T. milletiana." *E. Forbes.*—Nor is the Turbinolia figured by Mr. R. C.

Taylor, in Loudon's Mag. N. Hist. iii, p. 272, c. probably different in species, although I have not seen a specimen so broad at the base as it is there represented.

25. Caryophyllia,* Lamarck.

Character. *Animal like the Actinia: Polypidom permanently fixed, simple, striated externally in a longitudinal direction, the top hollowed into a lamellated stellular cup.*

1. C. Smithii, *lamellæ entire, arched, faintly crenate, from three to five smaller ones between the larger ; centre tubercular.* Rev. Dr. Fleming.

Plate XXXV. Fig. 4—8.

Caryophyllia cyathus, *Fleming* in Wern. Mem. ii. 249 ; and in Edin. New Phil. Journ. viii. 70. *Broderip* in Ibid. viii. 312. *Flem.* Brit. Anim. 508.—C. Smithii, *Stokes* and *Broderip* in Zool. Journ. iii. 486, pl. 13, fig. 1–6 ; and in Bull. des Sc. Nat. xvii. 157. *Buckland* Bridgew. Treat. ii. 90. pl. 54, fig. 9-11. *Harvey* in Proc. Zool. Soc. 1834, part ii. 28 ; and in Mag. Nat. Hist. New Series, i. 474, fig. 55. *Thompson* in Ann. Nat. Hist. v. 251. *Portlock's* Lond. 334. *Couch* Zooph. Cornw. 29 : Corn. Faun. iii. 72, pl. 12, fig. 3.—Caryophyllea sessilis, *Bellamy's* S. Devon, 267 and 330, pl. 18.

Hab. On rocks and old shells. "From deep water off Foulah, in Zetland," *Fleming.* Southern coast of Devonshire, *Thomas Smith, Esq.* Cornwall, abundant, *Mr. Couch.* Youghal, *Miss Ball.* Bundoran, co. Donegal, *R. Ball.* Firmly attached to boulders of granite in Dalkey island : Wexford bay : coast of Connemara, *Wm. M'Calla.* Oban, *J. Alder.*

The Polypidom is firmly attached to the rock so as often apparently to make a part of it : it is inversely conical or cylindrical, whitish stained with brown, striated or finely grooved on the exterior, internally cupped and lamellar. The lamellæ are of three kinds, a larger and more prominent, between every pair of which there are

* From καρυον, a nut, and φυλλον, a leaf.—The name has been so generally received, that it might be difficult to substitute another for the genus, and yet it is very objectionable. There is a *Caryophyllæus* among the intestinal worms ; and the *Caryophylleæ* are familiar to all botanists. The following generic character of *Caryophyllia* is given by Mr. Stokes : "Polyparium simplex, basi affixum. Corona laminis duplici serie dispositis, exterioribus majoribus, regulariter inæqualibus, maximis inter serici internæ laminas interpositis. Discus lamellis erectis, prominulis foliatis."—See also Lam. An. s. Vert. 2de edit. ii. p. 346. The British species belongs to the genus Cyathina of Ehrenberg.

generally three, but sometimes five lesser ones, of which the central one differs from the others in being divided into two portions, the innermost half projecting beyond the others towards the centre and forming an inner series.* All the lamellæ are arched, entire, striated on the sides, whence the margin appears somewhat crenulate : they terminate about half way across leaving a plain centre which is rough or tubercled. In one specimen before me the primary lamellæ are 14 in number ; in another they are 20 ; Mr. Couch says that they vary from 12 to 20 ; but Dr. Fleming gives about 40 as the number in his Zetland specimen. A fine specimen from Oban, an inch in diameter, and the same in height, has 67 lamellæ in all, of which 12 only are larger than the others. Height from one-eighth to an inch ; diameter three-tenths to one inch.

"The shape of this species is subject to variation, being either conical or cylindrical. The cylindrical, the *C. sessilis* of Bellamy, is low, and may be said to be blended with the rock on which it stands; while the conical ones, which have a footstalk, when arrived at a certain size, may frequently be removed with the fingers. This I considered to be the Turbinolia borealis of Dr. Fleming, which is described as being 'widely conical and slightly bent,' and said to become detached by age, but Dr. Johnston tells me it is the C. Smithii of his work." *R. Q. Couch.*

"It is to be found of all sizes, from a mere speck to an inch in height. In a very young state it is sometimes found parasitical on the Alcyonium digitatum, on shells, and the stalks of sea-weed ; but as these substances are very perishable in their nature, and offer no solid foundation on which to stand, large specimens are never found on them ; on rocks and stones, however, they are frequently large and in great profusion. In the youngest state the animal is naked,

* Dr. Fleming describes the plates thus: "The lamellæ are disposed in fours, and may be distinguished into three different kinds. The first are the highest and the broadest at the margin ; but as they descend into the disc, they become narrower before they join the central plate. The second kind are narrower than the preceding at the margin, but towards the middle they suddenly enlarge and join the middle plate. The third kind are the smallest, and terminate before reaching the middle plate. The space included between a pair of the first kind of plates contains one of the second kind in the middle, with one of the third kind in each of the lateral spaces. Those on the sides are rough, with small scattered tubercles, and their margins are curled. This last circumstance occasions the roughness externally, where the longitudinal striæ are the remains of the gills. The plate which occupies the bottom of the cavity is smooth, variously twisted, and connected with the base of the lateral plates."

and measures about the fifteenth of an inch in diameter, and about the thirty-second of an inch in height. In the earliest state in which I have seen the calcareous polypidom, there were four small rays, which were free or unconnected down to the base; in others I have noticed six primary rays, but in every case they were unconnected with each other. Other rays soon make their appearance between those first formed; they are mere calcareous specks at first, but afterwards increase in size. The first union of the rays is observed as a small calcareous rim at the base of the polype, which afterwards increases both in height and diameter with the age of the animal." *R. Q. Couch.*

My friend Dr. Coldstream has furnished me with the following account of the animal of this interesting zoophyte, which he watched for several successive weeks during his residence at Torquay. "When the soft parts," he writes, "are fully expanded, the appearance of the whole animal resembles very closely that of an Actinia. When shrunk they are almost entirely hid amongst the radiating plates. The specimens I have seen have varied in size from three-tenths to one inch in diameter, and from two-tenths to half an inch in height. They are found pendant from large boulders of sandstone just at low water-mark; sometimes they are dredged from the middle of the bay. Their colour varies considerably; I have seen the soft parts white, yellowish, orange-brown, reddish, and of a fine apple green. The tentacula are usually paler. During expansion, the soft parts rise above the level of the calcareous disc to about twice its height. The tentacula are pushed forth very slowly, but sometimes are as long as the whole height of the body. They are terminated by a rounded head.* The mouth has the appearance of an elongated slit in the centre of the disc: it is prominent, and the lips are marked with transverse striæ of a white colour. When a solid body is brought into contact gently with the tentacles they adhere pretty strongly to it, just as the Actiniæ do; but when they are rudely touched, they contract very quickly, and if the irritation be continued, the whole soft parts sink within the calcareous cup."

To render this account of our Caryophyllia more complete, I add the description of the animal taken from specimens which were dredged by Professor E. Forbes and Mr. MacAndrew in eighty fathoms, off Foula, Zetland, adhering to the shell of a dead Pleurotoma. The existence of so vividly coloured an animal at so great a depth is

* "They are nearly transparent except at the termination, which is a little ball, white and opake."—*De la Beche.*

worthy of remark. "When taken," says Professor Forbes, "the animal was scarcely visible, being contracted. When expanded the disc was conspicuously marked by two dentated circles of bright apple green, the one marginal and outside the tentacula, the other at some distance from the transverse and linear mouth. The tentacula are in two rows, rather short, conical, with inflated or globular tips, which are tinged with orange, their bases and the rest of the disc being of a tawny grey: they are minutely granulated.—In the dark the animal gave out a few dull flashes of phosphorescent light."

Mr. Swainson mentions that the Caryophyllia ramea, common in the Mediterranean, is occasionally found upon the Cornish coast. Murray's Encyclop. of Geography, p. 343. London, 1840. There is probably some mistake in this, for it is unlikely that such a species would have escaped the notice of Mr. Couch, or of Mr. Peach.

Madrepora musicalis, *Lin.* Syst. 1278. *Berk.* Syn. i, 211. *Turt.* Gmel. iv, 625. *Turt.* Brit. Faun. 204.—Said to be sometimes cast on the Irish coast; but without the slightest claim to denization.

Madrepora porpita, *Turt.* Gmel. iv, 616.—A fossil confounded with the M. porpita of the Indian seas.

Millepora truncata, *Stew.* Elem. ii, 426.—Marked erroneously as British.

Millepora lichenoides, *Turt.* Brit. Faun. 204. *Turt.* Gmel. iv, 635.—I am not aware on what authority this has been introduced into our Fauna by Dr. Turton. Ellis says nothing that can lead one to suppose that his specimen was British.

III. ZOANTHINA.

Ehrenberg, *Corall. des roth. Meeres.* p. 45.

Les Zoanthes, *Cuv.* Reg. Anim. iii. 293.—Les Zoanthaires coriaces, *Blainv.* Actinol. 328.—Zoanthidæ. *J. E. Gray* in Syn. Brit. Mus. 129.

Character.—*Animal actiniaform, gregarious and compound, arising from a common fleshy or coriaceous base, either root-like and creeping or crustaceous.*

26. Zoanthus,* Cuvier.

Character.—*Polypes distant, united by a creeping root-like fleshy band.*

* From ζῶον, animal, and ανθος, a flower.—Lamarck and Schweigger write the name Zoantha. In his Nomenclator Zoologicus, Agassiz ascribes the establishment of the genus to Lamarck.

1. Z. Couchii, *body cylindrical; tentacula in several circles.* R. Q. Couch.

PLATE XXXV. FIG. 9.

Zoanthus Couchii, *Couch* Corn. Faun. iii. 73, pl. 15, fig. 3.

Hab. "On flat slates and rocks in deep water, from one to ten leagues from the shore, throughout the Cornish part of the British Channel: Common." *R. Q. Couch.*

"This, in being compound, differs from all other European species of the order, and approaches very closely in form to the *Actinia sociata* of Ellis. It is a very small species, and composed of a number of Actiniæ united together at their bases by a thin encrusting fleshy band. It is of a light sandy or opaque red colour, and its surface is minutely glandular. In its contracted state it is sub-conoidal, resembling both in shape and size a split pea. When living, except that it is glandular, its surface is plain, but when preserved it becomes corrugated. When semi-expanded, which is its favourite state, it elevates itself to about twice its former height, and becomes contracted about its middle into an hour-glass form. The upper portion is lighter than the lower, and the superior or oral surface is marked by a central depression or mouth, and from it radiate to the circumference numerous rows of whitish glandular-looking bodies, which are the tentacula in a contracted state. When the creature is fully expanded, the tentacula become distended and elongated to about the length of the transverse diameter of the body; and they are generally darker at their extremities than towards the base. Like all the Actiniæ, the present species possesses a power of considerably altering its shape; most frequently it is in the shape of an hour-glass, at others the oral surface is contracted to a mere point, and then occasionally is again enlarged to nearly twice the size of any other part; sometimes the mouth is depressed, and at others is elevated into an obtuse cone. This species in addition to being rooted is one of the most inactive of its order; for whether in a state of contraction or expansion, it will remain so for many days, or even a week, without apparent change. If it should be in an expanded state, a touch will make it contract, and it will, most commonly, remain so for several days. Its most favourite state, is the semi-expanded, in which it will sometimes remain from a week to a fortnight without change.

"The trailing connecting band is flat, thin, narrow, and of the

same texture as the polype, and glandular. It frequently gets enlarged into small papillary eminences, which, as they become enlarged, become developed into polypes." *R. Q. Couch.*

I have had the pleasure of naming this the only European Zoanthus after its discoverer, the son of Jonathan Couch, Esq., of Polperro, so well known to naturalists, especially for his ichthyological discoveries. The son has carried his researches into a different field, and it has been to him productive of many additions to our Fauna, which he has incorporated in a very excellent "Cornish Fauna."

IV. ACTININA.

Ehrenberg, *Corall. des roth. Meer.* p. 31.

FAMILY—ACTINIADÆ.

Genus ACTINIA, *Lin.* Syst. 1088. *Soland.* Zooph. 1.—Les ACTINIES, *Cuv.* Reg. Anim. iii. 291.—ACTINIADÆ, *J. E. Gray* in Syn. Brit. Mus. 134.

CHARACTER. — *Animal single, fleshy, elongate or conical, capable of extending or contracting itself, fixed by its base, but with the power of locomotion : mouth in the middle of the upper disc, very dilatable, surrounded by one or more rows of tentacula : oviparous and viviparous : marine.*

27. CAPNEA,* E. Forbes.

CHARACTER.—"*Body cylindric, invested in part by a lobed epidermis, and adhering by a broad base . Tentacula simple, very short, retractile, surrounding the mouth in concentric series.*" Forbes.

1. C. SANGUINEA, "*tentacula arranged in three series, sixteen in each : body and disc scarlet : epidermis brown.*" E. Forbes.

Kapnea sanguinea, *Forbes* in Ann. and Mag. Nat. Hist. vii. 82, pl. 1, fig. 1, *a, b, c, d.* Reports publ. by Ray Soc. 379.

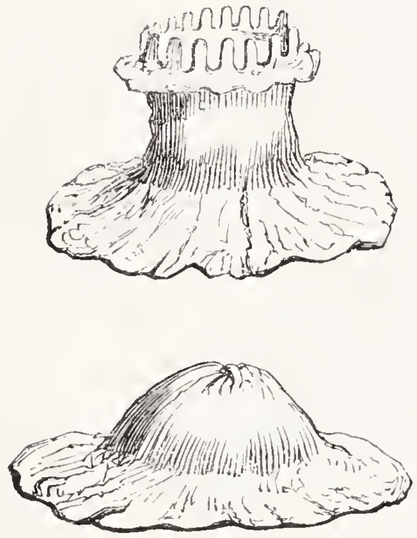
Hab. Deep water. Isle of Man, *E. Forbes.* On the valve of a Pecten maximus, four leagues west of Falmouth, *W. P. Cocks.*

"In August, 1840, I dredged on the east coast of the Isle of Man, about a mile from Douglas Head, a very remarkable and beautiful zoophyte, of the family *Actiniadæ.* It came from a depth of 18 fathoms, and the sea-bottom at the place where it was taken is chiefly *Millepora.* To a fragment of that coral it was adhering by

* From καπνη, a chimney.

its expanded base, and when taken, its tentacula were retracted. The body presented the appearance of a lengthened cylinder arising from a broad-spreading inflated base, and terminating in a round tentaculiferous disc, in the centre of which is a circular mouth. The tentacula are very short, and have the aspect of squared tubercles. They are arranged in three circles, sixteen in each circle, those of the outermost or marginal row largest. Below the tentacula and surrounding the disc is a granulated calycine circle or belt; and a little below it, extending downwards over a portion of the base, the body is invested by a woolly, brown epidermis, which is eight-cleft or lobed at its upper part. The base is somewhat lobed, and usually swelled out with sea-water. The body and base are of a vivid vermilion colour, the latter with darker longitudinal stripes. The tentacula are somewhat paler and inclined to orange. They can be drawn within the body, the upper part of which can be retracted as low as the commencement of the epidermis. When fully expanded, this animal was an inch in height by one-fourth of an inch broad at the disc. It is rather an active creature, changing its form often, but always presenting more or less of a tubular shape, like a chimney-crock or steam-boat funnel. (Fig. 43.)

Fig. 43.



"The shape of the tentacula and the presence of a regular epidermis are the most remarkable features of this *Actinea*, and distinguish it at once from all its tribe. Its general form and calycine rim approach to the *Actinea bellis* and some other species appertaining to the genus *Actinocereus* of Blainville. The epidermis and the imperforate tentacula separate it from Ehrenberg's restricted genus *Actinea*, and the absence of dermal pores from his *Cribrina;* neither of which divisions, as defined by that naturalist, I am inclined to admit, and therein agree with my friend Dr. Johnston. It is more nearly related to the *Zoanthidæ* than any known species of its family, and presents a most interesting transition from the typical *Actiniadæ* to that tribe. The regular form of the singular epidermis would lead us to consider that appendage as an imperfect tube, and some curious analogies might result from such a view. Both the number of the tentacula and of the clefts or lobes of the epider-

mis being multiples of four, is important, as supporting the notion that four is the typical or dominant number of the *Actiniadæ*, perhaps of all Zoophytes."

28. Corynactis,* G. J. Allman.

Character.—"*Body subcylindrical but very mutable in figure, adhering by an expanded base: Tentacula tubular, with spherical and imperforate capitula, contractile surrounding the mouth in one or more concentric series.*" G. J. Allman.

1. C. viridis. G. J. Allman.†

Plate XXXV. Fig. 10, 11.

Corynactis viridis, *Allman* in Ann. and Mag. Nat. Hist. xvii. 417, pl. 11.

Hab. Near low-water mark, in the pools left by the retiring tide, at Crook Haven, co. Cork, *G. J. Allman.* Coast of Cornwall, *C. W. Peach.*

"This beautiful little zoophyte measures nearly half an inch across the tentacular disc, which, as well as the body, is of a bright grass-green, with the exception of a circle of radiating brown striæ which surround the mouth at a short distance from its margin. The tentacula are short, with the stems of a sienna colour, and the capitate extremities of a bright rose colour. Those tentacula which lie near the margin of the disc are arranged in two regular concentric circles, and are succeeded towards the mouth by others, which are for the most part smaller, and present a more scattered disposition.

"There is a variety by no means uncommon, in which the green colour, except in a narrow ring at the upper margin of the body, is entirely replaced by a light flesh-colour. In this variety the animal becomes so translucent that the septa and vermiform filaments may often be distinguished through the integuments; it is an evident example of albinism.

"So exceedingly mutable is Corynactis viridis, perpetually exhi-

* From κορυνη, a club, and ακτιν, a ray.

† George James Allman, Professor of Botany in the University of Dublin, and a member of the naturalist-family of Irishmen, who, richly endowed with a love of Science, are prosecuting her with characteristic ardour, and loading the favourite with presents—rare, new, and valuable. This family of "co-operating advancers" count me for a relative: so I conclude, because of the liberality with which they have contributed to my wants.

biting some new and strange form, according to the state of contraction in which it may happen to present itself, that all attempt to limit its figure in description would be vain. At one time it will assume the appearance of a narrow cylindrical stem fixed by one extremity, and bearing on the opposite a flattened circular disc attached to the stem like the blade of a peltate-leaf to its petiole; sometimes a contraction will occur in the centre of the body, so as to cause the animal to present somewhat the appearance of an hour-glass; again, the central part of the tentacular disc will be forced forward into a conical projection, bearing the two outer circles of tentacula around the margin of its base, and with the mouth elevated upon its apex. This occurs without any eversion of the stomach. In short, the strange shapes assumed by this protean polyp are innumerable, and altogether beyond the domain of description.

"Corynactis viridis is a charming little animal, and by no means rare in the locality where I discovered it; the brilliancy of its colours and the great elegance of its tentacular crown when fully expanded, render it eminently attractive; hundreds may often be seen in a single pool, and few sights will be retained with greater pleasure by the naturalist than that presented by these little zoophytes, as they spread abroad their green and rosy crowns amid the algæ and millepores and plumy corals, co-tenants of their rocky vases."—*G. J. Allman.*

Mr. Peach's specimens were "all yellowish at the upper part and flesh-colour and faintly striped to the foot, some a deeper red," the mouth very light flesh-colour, and the peristomatous space light yellow, "the divisions being shown by fine lines of bright yellow." The animals assumed various shapes, but their favourite position was to hang from the rock when in the form of the daisy. Slow in their motions, and not very irritable, they soon opened after being touched; and in other respects their habits were those of their family, except in being more tender, for they could not be kept alive longer than two or three days, although constantly supplied with fresh sea-water.

The *Actinia iris* of Muller, Zool. Dan. iii. 3, tab. 82, fig. 5, 6, appears to be related to Corynactis.

29. Adamsia,* E. Forbes.

Character.—" *Body expanded, bilobed, adhering by a broad base: tentacula subretractile, simple, surrounding the mouth.*" Forbes.

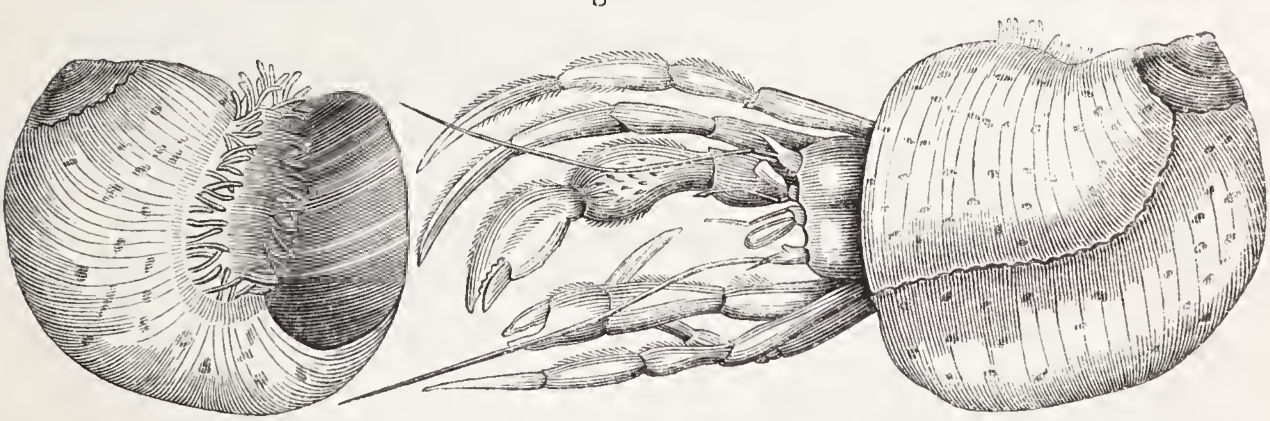
1. A. palliata. J. Adams.

Plate XLII. Fig. 1, 2.

Medusa palliata, *Bohad.* Anim. Mar. 135, tab. 11, fig. 1.—Actinia maculata, *Adams* in Lin. Trans. v. 8. *Coldstream* in Edin. New Phil. Journ. ix. 236, tab. 4, fig. 6, 7; and in Edin. Journ. Nat. and Geogr. Sc. iii. 49. *Forbes* in Ann. Nat. Hist. iii. 48. *W. Thompson* in ibid. v. 251. *Hassall* in ibid. vii. 286.—Act. carciniopados, *Otto* in Nov. Act. Acad. C. L. C. Nat. Cur. xi. 288, pl. 40. *D. Chiaie* Anim. s. Vert. Nap. ii. 242. *Rapp*, Polyp. 58. *Grube* Actin. 13.—Cribrina palliata, *Ehrenb.* Corall. 41; and Lam. Anim. s. Vert. 2de édit. iii. 426.—Actinia picta, *Risso* l'Europ. merid. v. 286.—Act. effæta. *Turt.* Gmel. iv. 101. *Turt.* Brit. Faun. 131.—Parasite Actinia, *Landsborough* in Scottish Christian Herald, ii. 333.—Adamsia maculata, *Forbes* in Ann. Nat. Hist. v. 183.

Hab. Milford Haven, surrounding the apertures of deserted shells of the Murex despectus, *Adams.* Torbay, and in Rothesay and Kames Bays in Bute, either thrown ashore after easterly gales, or drawn in by flounder-nets, *Dr. Coldstream.* Stevenston, Ayrshire, *Rev. D. Landsborough.* On the coast of the Isle of Man, " where it is extremely common on old Fusi and Trochi in deep water," *E. Forbes.* " This extremely beautiful species, taken by dredging in Strangford Lough, in January, 1835, by Mr. Hyndman and myself, has subsequently occurred to us commonly there and in Belfast

Fig. 44.



* " I have named the genus Adamsia, after Mr. Adams, who first noticed it, and who contributed largely to the British Fauna in an age less favourable to natural history than the present." *E. Forbes*—His Christian name was John. In two papers published in the " Linnæan Transactions," he has described several new shells, and some other invertebrate animals, found on the coast of Pembrokeshire.

Bay :—to *Bulla lignaria* as well as the larger *Trochi* it is occasionally found attached." *W. Thompson.*

"This beautiful species is longitudinally sulcated, having the edges of the base crenated : the lower part is an obscure red, and the upper part is transparent white marked with fine purple spots; the outer circumference of the aperture has a narrow stripe of pink. When expanded, the superior division of the body seems formed of fleshy bars placed in a reticulated manner, and lined with a fine membrane. From perforated warts, placed without order on the outer coat, issued white filamentose substances variously twisted together. I have observed a similar body ejected from the mouths of all the species of this genus which have fallen within my notice."—*Adams.*

The following more detailed description of this very interesting species is by Dr. Coldstream :—"General mass of the animal flattened and extended; thickness at the oral disc three-tenths of an inch, diminishing towards the circumference of the base; longest diameter of the base about three inches; margin minutely crenated; colour of the body, near the base, reddish brown, passing gradually into a light cream colour towards the oral disc; whole surface striated longitudinally with alternate opaque white, and translucent bluish lines, and marked irregularly with bright reddish-purple spots. These spots are confined to the outer coat, which is easily peeled off. That below it is of a pink colour, and is marked with the striæ, which shine through the outer coat. Oral disc of an elongated oval form, white, and bearing on its outer margin numerous rather short tentacula arranged in three or four irregular rows : tentacula shorter than the body, acuminated, white, each marked with a faint streak of brown; mouth large, oval; lips white, contracted into folds; internal surface of the stomach marked with numerous white striæ. Base fixed to a thin horny expansion attached to the apertures of various dead shells, such as Trochus cinerarius and T. Magus, and forming, as it were, an extension of the body-whorl of the shell in a spiral form. Over this, the Actinia is spread entirely, and covers also more or less of the shell. Its oral disc is uniformly situated close to the inner lips of the horny case. The aperture of the case is accurately surrounded by its body, the margins of the opposite sides of which meet, and are closely applied to one another at the middle of the outer lip of the aperture, whence they run upwards towards the old shell, where they generally separate again, leaving its apex uncovered."——"The horny membrane

to which the Actinia is attached covers, for the most part, nearly the whole of the external surface of the old shell to which it is fixed, and from the circumference of its aperture, is prolonged into a large hollow expansion, resembling in form, and occupying, relatively to the shell, the place of a ventricose body-whorl. Its substance is of a uniform thickness throughout its whole extent, of a greenish-brown colour, translucent, having both surfaces irregularly wrinkled transversely. In a recent state it is quite flexible, but when dried it is brittle. It takes fire and burns readily, leaving a very small residuum, which does not effervesce with acids. It is insoluble in boiling water and in alcohol, but dissolves slowly in acids, and in solutions of the alkalies. Its general appearance may be compared to that of the cases of Tubularia indivisa, except in point of colour."

"The case thus formed by the old shell and the horny membrane, and covered by the Actinia, I have *always* found inhabited by a variety of the hermit-crab."——"Its natural history is perhaps doubtful. Is the horny case secreted by the Actinia? Or is it the dead axis of some zoophyte, like that which covers old Buccina (Alcyonium echinatum, *Flem.*), and which I have found forming an extension of the body-whorl of the Turbo littoreus, also inhabited by the Pagurus? Or, is it likely that the old shell, with a young crab in it, may have been swallowed by the Actinia; that the crab may have forced its way through the walls of the stomach and the integuments of the latter, and that the Actinia then secreting a peculiar membrane to defend its base, the crab may have found itself provided with a habitation suited to its wants? To this last supposition an objection is found in the fact, that the full-grown shell of Trochus Magus forms sometimes the base of the horny case, and this shell is too large to enter the mouth of the Actinia. It seems to be probable that the horny membrane is produced by the Actinia; and that its formation presents a striking instance of the operation of that beautiful law of Nature which makes the habits of one animal subservient to the wants of another."*

* "Many naturalists," says the Rev. D. Landsborough, "have observed that there seems to be a treaty of union betwixt the hermit-crab and the *spotted sea-anemone* (*Actinia maculata*). I lately kept one of these pretty *sea-anemones* for some days in sea-water; it had fastened itself to a little fragment of a screw-shell (*Turritella*), but its co-tenant in the inside was not a hermit-crab, but a pretty red annelide. Be this as it may, certain it is that, on this occasion, we found that the *spotted anemone* had fastened itself to the outer lip of many of the large *roaring buckies* (*Buccinum undatum*) brought up, and wherever there was an *anemone* without, there we found a

The experience of Mr. Thompson coincides with Dr. Coldstream's. He says :—"Every shell that I have seen the A. maculata invest was tenanted by the Pagurus Prideauxii, *Leach*, a species which, extensively as the native Paguri have been collected by me, never occurred under other circumstances."—This testimony proves a general confederacy between these animals, but the union is often dissolved, and it is doubtful whether any benefit to either ever flows from it. Professor Forbes assures me that on the coast of the Isle of Man the shells to which the Adamsia attaches itself are *seldom* inhabited by the hermit-crab; neither is the horny base always present. On one dredging excursion not a single specimen had either crab or horny disc. Mr. Forbes adds, that the Adamsia "seems to change its habitation according to its size."

Professor Forbes has found an unspotted variety on the Manx coast.

30. Actinia,* Linnæus.

Character.—*Body conoid or cylindrical, adhering by a broad base: the space between the mouth and the rim of the upper disc occupied by one or more uninterrupted series of conical undivided tubular tentacula which are entirely retractile.*

† Skin smooth.

1. A. mesembryanthemum, *body smooth, conoid in contraction; tentacula numerous, multiserial, subequal; margin of the oral disc with a circle of azure-blue tubercles.*

Plate XXXVI. Fig. 1—3.

La plus petite des Orties de mer, *Rondel.* Poiss. 380. (quoad fig.)—Ortie de mer, *Reaumur* in Mem. de l'Acad. Roy. des Scienc. 1710, pl. 10, fig. 22.—Priapus equinus, *Lin.* Syst. edit. 10. 656.—Hydra disciflora, tentaculis retractilibus, extimo disci margine tuberculato, *Gærtner* in. Phil. Trans. lii. 83, pl. i. fig. 5. Phil. Trans. abridg. xi. 529.—Actinia equina, *Lin.* Syst. 1088. *Dicquemare* in Phil. Trans.

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hermit within. In all likelihood, they in various ways aid each other. The hermit has strong claws, and while he is feasting on the prey he has caught, many spare crumbs may fall to the share of his gentle-looking companion. But, soft and gentle-looking though the *anemone* be, she has a hundred hands; and woe to the wandering wight who comes within the reach of one of them, for all the other hands are instantly brought to its aid, and the hermit may soon find that he is more than compensated for the crumbs that fall from his own booty."

* From *ακτιν*, a ray.

lxiii. 364, pl. 16, fig. 1—7. † *Mull.* Zool. Dan. prod. 231. *Flem.* Brit. Anim. 497. *Cuv.* Reg. Anim. iii. 292. *Johnston* in Trans. Newc. Soc. ii. 243. *Dalyell* in Edin. New. Phil. Journ. xvii. 411 ; and in Proc. Brit. Assoc. 1834, 599. *Templeton* in Mag. Nat. Hist. ix. 303.—Act. mesembryanthemum, *Ellis* and *Soland.* Zooph. 4. Encyclop. Meth. Vers. pl. 73, fig. 3.—*Turt.* Brit. Faun. 131. *Rapp* Polyp. 52, taf. 2, fig, 1. *Johnston* in Mag. Nat. Hist. viii. 81, fig. 12. *Grube* Actin. 10. *Couch* Zooph. Cornw. 31 : Corn. Faun. iii. 74, pl. 14, fig. 1. *Hassall* in Ann. and Mag. Nat. Hist. vii. 285.—Act. hemisphærica, *Penn.* Brit. Zool. iv. 104. *Berk.* Syn. i. 186. Hogg's Stock, 30.—Act. rufa, *Penn.* Brit. Zool. iv. 105. *Jameson* in Wern. Mem. i. 558. *Stew.* Elem. i. 393. *Roget* Bridgew. Treat. i. 198, fig. 86, 87.—Act. corallina, *Risso* l'Europ. merid. v. 285.—Common Actinia, *Buckland* Bridgew. Treat. ii. 89, pl. 54, fig. 4.—Small red Sea-Nettle, *Wallis* Hist. of Northumb. i. 374.—Hydra mesembryanthemum, *Stew.* Elem. ii. 451.

Hab. On rocks between tide marks, very common.

Body one, or one and a half, inch in diameter, hemispherical when contracted, when relaxed forming a short cylinder with a breadth greater than the height; of a uniform liver-colour, or often olive-green, and sometimes streaked with blue or greenish lines, either continuous or in spots : the base generally of a greenish colour, encircled with an azure-blue line, but it is often also streaked with red, and the blue marginal line is occasionally wanting. The tentacula, when fully extended, are nearly equal to the height of the body, and of the same colour, or a shade lighter. There are about 25 blue tubercles in a full-grown specimen; they are situated within the margin of the oral disc, and are formed by papillary projections of the parenchyma of the body, covered over on the top with a thick layer of dense blue matter : in it, as well as in the skin generally, minute fusiform spicula, some slenderer than others, may be detected in abundance with the microscope. Mr. Bailey suspects that these spicula are siliceous (Ann. and Mag. N. Hist. xii. 39), but as I find them to be entirely destroyed by burning, and not altered by the action of vinegar, they are probably horny. On each side of the mouth, in the median line, there is a small purple spot; and the mouth itself is encircled with a fringe of numerous very short tentacles, of a pale or roseate colour, which is rarely exposed, and has been hitherto unnoticed.

Except in colouring, this our commonest species is not subject to much variety. It is a cleanly animal, and loves the purest water, in

† Dicquemare himself uses no specific names : they were applied to his figures by Dr. Solander, who, it is to be presumed, was well acquainted with the Linnæan species. To those acquainted with the subject, it is unnecessary to assign a reason for the unconditional rejection of Linnæus' specific names.

pools of which it expands prettily and discloses its beauty. It roots itself upon rocks and stones, and ranges from the line of the recess of the tide to near that of high water. It is consequently often left exposed to the open atmosphere, but it expands only when covered with water. It never, so far as I have observed, emits from the mouth, like the other species, any thread-like tangled filaments; nor does it seem to have the power of protruding the membrane of the stomach in the form of vesicular lobes. Gærtner says that "the colour of its body is always red in the summer, but changes into a dusky green, or brown, towards the latter end of autumn,"—a remark which certainly does not hold good on the shores of Britain nor on those of Ireland.

The number of marginal tubercles varies from eight only to upwards of twenty. Professor Forbes says that they are sometimes wanting. This variety may possibly be the *Actinia rufa* of Müller, and of those authors who have copied him; but neither in his figures nor description does Müller make any mention of these organs, and Rapp gives the species as distinct. The *Actinia concentrica* of Risso (L'Europ. merid. v. p. 286), appears to be founded on the azure-blue streaked variety, which is very pretty. Nor less so is a small green variety, in which the body is covered with golden-coloured dots arranged in longitudinal lines.

The young differ from the adult only in having fewer tentacula, which are at first produced in a single series.

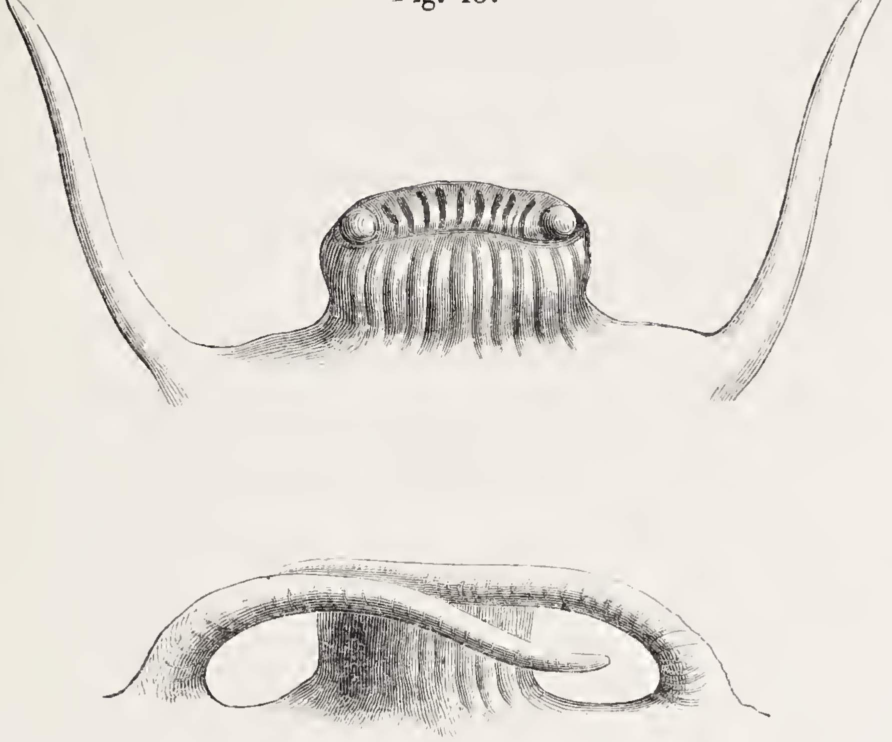
That our species is synonymous with the *Entacmaea mesembryanthemum* of Ehrenberg (Corall. p. 36) is very doubtful.

The blue eye-like tubercles on each side of the mouth become visible only when the labial membrane is extruded. They vary in colour in the different varieties, and are never absent. They are common to the genus, (at least, Mr. Cocks has found them in all the species that have come under his notice,*) but they vary in hue, and a little in the depth of their colouring. Their function is uncertain. Mr. Cocks inclines to believe that they are organs of vision, for in a subdued light he found that Actinia mesembryanthemum left them exposed, but bent the tentacula over them, as if to shade them, when exposed to the bright rays of the sun. (Fig. 45.) To confirm Mr. Cocks' conjecture it would be necessary, I think, to

* Grube discovered these organs, and called the species in which he observed them *Act. bimaculata.* Actin. p. 4, fig. 4.—This seems to me to be a variety merely of Act. coriacea.

discover in the anatomy of the parts in question some organization instrumental to sight.

Fig. 45.



2. A. MARGARITIFERA, "*body subconic, low, and very much dilated at the base, deep brown inclining to chesnut, with longitudinal and concentric plaits; mouth conic, striated; at the base of the tentacula a series of light-blue ovate lobes.*" J. Templeton.*

Actinia margaritifera, *Templeton* in Mag. Nat. Hist. ix. 304, fig. 50.

Fig. 46.

Hab. "On the coast of the Copeland Isle; August, 1811," *J. Templeton.* West coast of Donegal Bay, *E. Forbes.*

"This is a very distinct species. Skin corrugated and coriaceous, striated longitudinally and transversely; tentacula rather short.

* John Templeton, Esq., born in Belfast in 1766. He resided through life at his country-seat, two miles distant, and died there, in 1827. For an interesting memoir of him see Loudon's Mag. Nat. Hist. i. p. 403; and ii. p. 305.

The integument is much tougher than that of A. mesembryanthemum, having a coriaceous feel. The body is never tumid and globose as that species usually is, but much depressed; and its colour was always, so far as I saw, of a dull olive green, with pale tentacula. The tubercles were of the most vivid ultramarine."—*E. Forbes.*

3. A. CHIOCOCCA, *conoid, smooth, red, unicolorous; tentacula numerous, nearly equal; tubercles of the oral disc white.* W. P. Cocks.*

PLATE XXXVI. FIG. 4—6.

Hab. "At extreme low-water mark, attached to clean and smooth stones or rocks. Rare at Falmouth, but at St. Ives found in great numbers: a few at Penzance, Newland, Mousehole, Merizion, St. Michael's Mount, and also on rocks situated in the bay midway between Penzance and St. Michael's Mount." *W. P. Cocks.*

"Shape much like that of A. mesembryanthemum; colour bright scarlet; tentacula filiform, and somewhat lighter and brighter than the body; edge of the disc studded with white tubercles; and a light flesh-coloured stripe encircles the edge of the base." *W. P. Cocks.*

4. A. CHRYSOSPLENIUM, *conoid in contraction, shortly cylindrical, green striped or dotted with bright yellow; tentacula annulated, nearly equal, and rather short.* W. P. Cocks.

PLATE XXXVII. FIG. 1—3.

Hab. Attached to stones at low-water mark, St. Ives, *W. P. Cocks.*

"A small species found attached to the under surface of stones in pools; the old ones are solitary, not more than one on a stone; but there are two or sometimes four young on the same stone. They vary in colour from a bright pea-green to the dark holly-leaf tint, striped or dotted with bright yellow; the (labial) tubercles and edging of the base of the same colour, but somewhat lighter in tint. I have had some of this species in my possession for weeks, well

* W. P. Cocks, Esq., of Falmouth. I am greatly indebted to this gentleman for numerous characteristic drawings and sketches of the Actiniæ, accompanied with remarks, of which I have freely availed myself; and the reader of this book "I hope, together with me, will be thankful to him, that he would so readily impart them for the further increase of this knowledge."

supplied with water and air daily, yet the tubercles and edging were obdurate, determined to keep to their original colour. I have met with some individuals that had light, almost white, tentacula barred with green stripes." *W. P. Cocks.*

5. A. COCCINEA, "*varied with white and red; tentacula cylindrical and annulate.*"

ACTINIA COCCINEA, "albo rubroque varia, cirris cylindricis annulatis," *Mull.* Zool. Dan. prod. 231, no. 2792. Zool. Dan. ii. 30, tab. 63, fig. 1—3 ; copied in Encyclop. Method. Vers. pl. 72, fig. 1—3. *Turt.* Gmel. iv. 101. *Bosc* Vers. ii. 255. *Lam.* Anim. s. Vert. iii. 68 : 2de edit. iii. 407.

Hab. On rocks and sea-weeds. Coast of Ireland, *E. Forbes.*

"*Corpus* cylindrico-truncatum, rubrum albedine mixtum, glabrum; margo superus duplici serie *tentaculorum* muricatus, viginti quatuor in quavis numero; hæc cylindracea, seu si mavis conica, alba, annulis binis rubris distantibus cinguntur, dimidia glandis diametro longitudine æqualia. Oculo armato annulis subtilissimis confertis composita videntur, lineaque obscura longitudinaliter pellucet. *Glans* glabra, centro fissuris perforata. Basis lutescens striis a centro divergentibus inscribitur, membranaque corporis laxa et varia plicata objectis affigitur.

"Uti congeneres ope tentaculorum locum mutat, tentaculisque conditis, meram membranulam rubram mentitur." *Muller.*

I formerly considered this Actinia to be the young of *A. crassicornis,* but I give it now as distinct on the authority of Professor E. Forbes.

6. A. VIDUATA, *grey with longitudinal white streaks; the tentacula white with a dusky streak along each side.* W. Thompson.*

ACTINIA VIDUATA, "grisea, strigis longitudinalibus cirrisque albis," *Mull.* Zool. Dan. prod. 231, no. 2799. Zool. Dan. ii. 31, pl. 63, fig. 6—8 ; copied in Encyclop. Method. tab. 72, fig. 4, 5. *Turt.* Gmel. iv. 101. *Lam.* Anim. s. Vert. iii. 68 : 2de edit. iii. 407. *Bosc* Vers. ii. 256. *W. Thompson* in Ann. and Mag. N. Hist. vii. 481.—Isacmaea viduata, *Ehrenb.* Corall. 34.

Hab. Between tide-marks. Müller's specimens were found on

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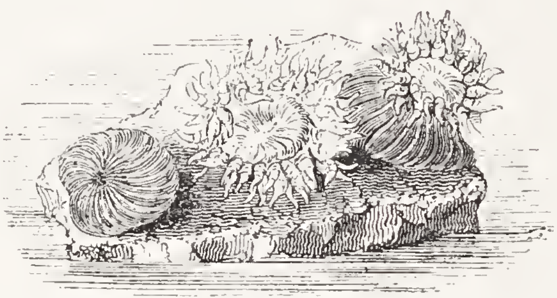
* President of the Natural History and Philosophical Society of Belfast—"quem ob propensum in me animum merito suo plurimum diligo, qui et opus ipsum variis observationibus ditavit ; inque ejus editione accurandâ exornandâque non minus diligens et industrius fuit, quàm si ipsemet ejusdem auctor fuisset."

the Fucus saccharinus. "Observed between tide-marks at Lahinch (co. Clare), by Mr. Forbes and myself," *W. Thompson.*

"Corpus pallide nigrum seu obscure griseum, conico-truncatum strigis viginti quatuor ac centro ad peripheriam baseos albis, alternis latioribus superne puncto pertuso inscriptis; inter has strigas alia tenuior et pallidior difficulter conspicitur. Centrum aperturæ rugosum, rubrum. Tentacula filiformia alba, foveola versus basin ac lineola duplici longitudinali obscura notantur." *Müller.*

7. A. TROGLODYTES, *body olive-green striped with many white rays; tentacula as long as the diameter of the oral disc, olivacious ringed with white.* G. J.

Fig. 47.



Actinia viduata, *Johnston* in Mag. Nat. Hist. viii. 82. fig. 13. *E. Forbes* in Ann. Nat. Hist. iii. 48.—Act. mesembryanthemum, var β, *Johns.* Brit. Zooph. 211.—Act. viduata, *Couch* Zooph. Cornw. 31: Corn. Faun. iii. 75.

Hab. On rocks between tide-marks. Berwick Bay, not rare, *G. J.* Coast of Cornwall, *R. Q. Couch.* In the Isle of Man found chiefly on the sandy shores, its base being fixed to pebbles and gravel below the sand, *E. Forbes.* Common in the Moray Firth, off the coast of Morayshire, *A. Robertson.*

The body, when contracted, forms a very depressed cone; when expanded, it is cylindraceous, about half an inch in diameter, and scarcely so much in height; smooth, olive-green striped with numerous rays of a snow-white colour diverging from the apex to the base: these are sometimes interrupted or broken into spots, and often some of them are narrower, shorter, and less distinct than others. The tentacula are numerous; in one specimen of medium size there were between thirty and forty arranged in two not very regular circles, and when fully extended they were rather longer than the diameter of the disc: they are cylindrical or slightly tapered, olivaceous with duskier tips, and prettily marked with three or four white rings. The oral disc is, in most specimens, beautifully painted with wood-brown rays and with white, brown,

and almost black spots, not very constant to any pattern, but usually challenging a comparison with some marbled feather.

This small but exceedingly pretty species has often interested us in observing its habits. It occupies a hole fitted to the size of its body in our shelving, soft, slaty rocks, where, when covered with water, it expands, in a wide circle, its oral disc and tentacula, raising them scarcely above the level of its habitation. Thus the Actinia retains itself unbosomed, as if proud to display the beauty that its Author has given it; but should perchance a rude hand or foe touch or ruffle the tentacula, then doth the creature instantly shrink and withdraw within itself and its furrow, until it has become nearly undistinguishable.

Often a tide will cover the rocks inhabited by a colony of the species with a thin layer of sand. In this case, with the assistance of the tentacula, and by emitting currents of water from the mouth, a small aperture is bored through the sand, through which the tentacula are displayed when the tide flows. At ebb nothing of the animal can be seen, and the holes in the sand scarcely betray it, for they are exactly similar to those of most arenicolous worms and mollusca.

The deserted holes bored by the Pholas is a favourite retreat for this Actinia; and hence the specific name suggested by Mr. Price, who finds what I consider to be the same species thus located on the shore at Birkenhead. In confinement, says Mr. Price, the creatures, "even when expanding their little tufty tentacula, keep pretty flat to the glass; and it is a favour to expand at all."

In the first edition of this work I have considered this a variety of *Act. mesembryanthemum*, with which it has truly no such near relationship, for it has no oral tubercles, and it differs not only in colour, but, as Mr. Forbes correctly remarks, "also in habit and shape, being always much more elongated." I had likewise too hastily identified it with *Act. viduata* of Müller, for a comparison of the descriptions will prove that they cannot be made to tally.

8. A. ALBA, *white, longitudinally ribbed, a white line traversing each rib from the oral aperture to the base; tentacula numerous, quadriserial, barred.* W. P. Cocks.

PLATE XXXVII. FIG. 4—7.

Hab.—Coast of Cornwall, embedded in the crevices of rocks, *W. P. Cocks.*

"Body semi-pellucid white, longitudinally ribbed with an opake and positive white line traversing each rib from the oral aperture to the base : three rows of minute white tubercles on the oral disc externally : four rows of filiform and transparent tentacula, barred, having opake white patches anteriorly : oral disc crossed by ribs equally strong in outline and marking as those on the body : mouth round : lips pouting and dotted with a bright chrome or yellow colour : height when expanded $\frac{4}{8}$ths of an inch ; diameter $\frac{1}{4}$ of an inch. When contracted it had the appearance of a rough wart, and it felt like one." *W. P. Cocks.*

9. A. ANGUICOMA, *smooth, conoid, cylindrical in extension, dull buff-brown with beautiful pale stripes broadest at the base ; tentacula numerous, very slender, subequal, unicolorous.* J. Price.

PLATE XXXVII. FIG. 8, 9.

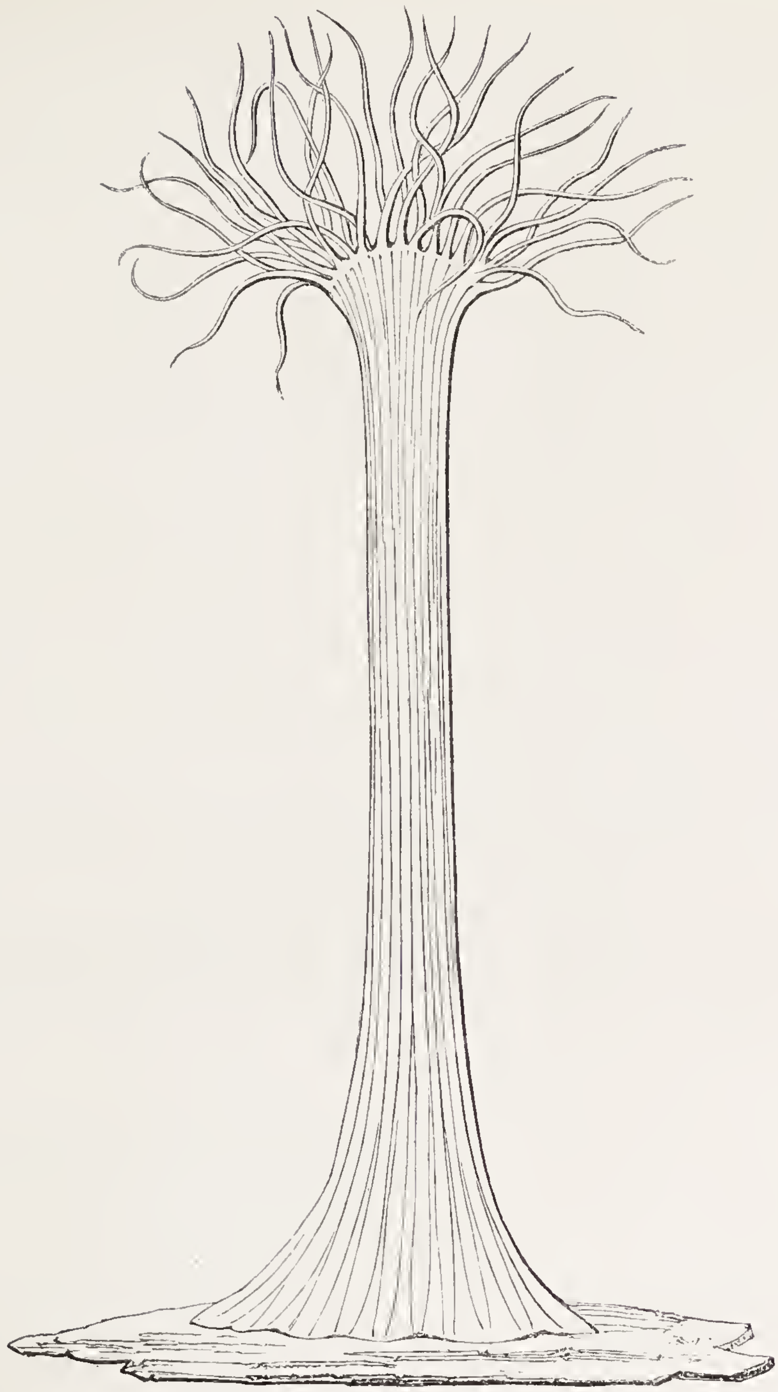
Actinia anguicoma, *Price* MSS.

Hab. In the Menai Straits, near Bangor, *J. Price.*

"Diam. of the base 1 inch : height $\frac{1}{2}$ inch to $5\frac{1}{2}$ inches. Presents, by turns, the two extremes of the greatest cylindrical length I have ever seen in any Actinia, and the most abject flatness. The former state (Fig. 48) is constant at night, and may be induced by artificial darkness in an hour or two. In the contracted form the tentacula are rarely visible, and always inconspicuous : they are about 50 in number, about $1\frac{1}{4}$ inch, and nearly of equal length, extremely slender and snake-like, each being bent ordinarily in two or three irregular curves, and, on being shaken, presenting a frizzled appearance. They are placed in three or four alternating tiers, near the margin, leaving a considerable bare space surrounding the mouth, which last is much crumpled, as in Act. dianthus, to which, however, the *tout-ensemble* of the animal presents a marked contrast. The lengthened form accords with its habits. The two individuals I found were attached (to a stone, probably) at the depth of about five inches below the sand, on the south side of the stepping stones at Garth Ferry, on the Bangor side.

"The *texture* of the body is dense and opake : the *colour* between flesh and fawn, sometimes with an orange tinge, with well-marked stripes of pale buff, alternately broader and narrower ; peristome or space round the mouth, elegantly striated dark brown and buff : mouth coarsely striped, pale brown and buff.

Fig. 48.

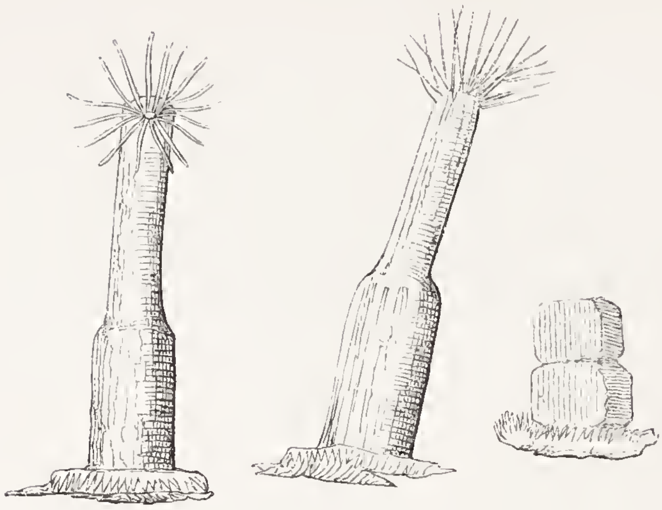


"In confinement Act. anguicoma is very sedentary, and will keep the same spot for months. It curls up the edge of the disc when infested with confervæ. In its natural state, it is found buried in sand in shallow pools, where it expands the head and tentacula on the surface." *J. Price.*

10. A. INTESTINALIS, "*body cylindrical, the upper half suddenly contracted and narrow.*" Dr. Fleming.

Actinia intestinalis *Fabr.* Faun. Grœnl. 350, no. 342, pl. 1, fig. 11. *Flem.* Brit. Anim. 498.

Fig. 49.



Hab. "Adheres to rocks at low-water mark, Zetland," *Fleming.*

"When contracted, the body seems like two broad rings, of nearly equal breadth, and about half an inch in diameter; when expanded to nearly two inches, the body consists of two cylindrical portions of different dimensions, smooth, pellucid, yellowish; a few longitudinal white streaks under the skin; oral disc not expanded, surrounded with about 18 filiform tentacula in two alternate rows." *Fleming.*

11. A. CHRYSANTHELLUM, *body cylindrical, smooth, striped; tentacula twelve, uniserial, submarginal, annulated with brown.* C. W. Peach.*

* "But who is that little intelligent-looking man in a faded naval uniform, who is so invariably seen in a particular central seat in this section? That, gentle reader, is, perhaps, one of the most interesting men who attend the Association. He is only a private in the mounted guard (preventive service), at an obscure part of the Cornwall coast, with four shillings a day, and a wife and nine children, most of whose education he has himself to conduct. He never tastes the luxuries which are so common in the middle ranks of life, and even amongst a large portion of the working classes. He has to mend with his own hands every sort of thing that can wear or break in his house. Yet Charles Peach is a votary of natural history—not a student of the science in books, for he cannot afford books, but an investigator by sea and shore, a collector of zoophytes and echinodermata, strange creatures, many of which are as yet hardly known to man. These he collects, preserves, and describes; and every year does he come up to the British Association with a few novelties of this kind, accompanied by illustrative papers and drawings: thus, under circumstances the very opposite of those of such men as Lord Enniskillen, adding, in like manner, to the general stock of knowledge. On the present occasion he is unusually elated, for he has made the discovery of a Holothuria with twenty tentacula, a species of the echinodermata, which Edward Forbes, in his book on star-fishes, had said was never yet observed in the British seas. It may be of small moment to you, who, mayhap, know nothing of Holothurias, but it is a considerable thing to the fauna of Britain,

Plate XXXVII. Fig. 10—15.

Hab.—Coast of Cornwall, *C. W. Peach.*

"This Actinia I find under stones buried in sand in Fowey harbour between the tide-marks. Body pale, nearly white, with six broad stripes, and three narrower ones between each of the two broader ones, the centre one of the three the broadest—all running the whole length of the body, but are nearly lost before reaching the lower end : these stripes are again divided by transverse narrow ones. The tentacula are invariably twelve : the mouth is in the centre, and surrounded by brown flower-like markings. It does not attach itself, but lies buried in sand, with its head just above."

"The species readily assumes various shapes, as shown in the figures of it. It is quick in its motions, and buries itself in the sand when disturbed," *C. W. Peach.*

12. A. biserialis, *cylindrical, elongate, dark brown with blue stripes ; oral disc round ; tentacula in two rows, those of the inner row three times as long as the outer ones, which are short and numerous.* E. Forbes.

Plate XXXVIII. Fig. 1.

Actinia biserialis, "corpore elongato-cylindrico, brunneo, cæruleo-lineato ; disco rotundo ; tentaculis in duabus seriebus digestis, serie internâ longissimâ, externâ numerosissimâ," *Forbes* in Ann. Nat. Hist. v. 182, pl. 3.

Hab. "Frequent among the rocks at low water in the island of Herm (Guernsey)," *E. Forbes.*

"A cylindrical species, appearing as if pedunculated, from the narrowness of the lower part of the body, about 1½ inch high and 1 inch across the disc. The oral disc is surrounded by numerous tapering tentacula in two rows, the inner row consisting of 16 long

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and a vast matter to a poor private of the Cornwall mounted guard. And, accordingly, he will go home in a few days, full of the glory of his exhibition, and strung anew by the kind notice taken of him by the masters of the science, to similar inquiries, difficult as it may be to prosecute them under such a complication of duties, professional and domestic. But he has still another subject of congratulation, for Dr. Carpenter has kindly given him a microscope, wherewith to observe the structure of his favourite animals, an instrument for which he has sighed for many years in vain. Honest Peach, humble as is thy home, and simple thy bearing, thou art an honour even to this assemblage of nobles and doctors : nay, more, when I consider everything, thou art an honour to human nature itself ; for where is the heroism like that of virtuous, intelligent, independent poverty ? and such heroism is thine !"—*Chambers's Edinburgh Journal*, Nov. 23, 1844.

tentacula, three times as long as the outer, placed at some distance from each other : the outer forms a circle of numerous shorter tentacula, about a quarter of an inch in length. The colour of the body is dark brown with blue stripes, which bifurcate towards the base. The tentacula are paler, as also the disc, which is ornamented with bright blue stripes radiating from the mouth." *E. Forbes.*

13. A. VERMICULARIS, *body elongate, cylindrical, smooth ; tentacula numerous, multiserial, those of the marginal circle twice as long as those of the mouth and less numerous.* E. Forbes.

PLATE XXXVIII. FIG. 2—5.

Actinia vermicularis, *Forbes* MSS.

Hab. On shells. "Dredged in 50 fathoms by Mr. MacAndrew and myself, between Sombro Head (Zetland) and Fair Island : also in 80 fathoms w. of Zetland," *E. Forbes.*

"Body cylindrical, long, smooth, greyish pink : neck not swollen, opake white : disc white, bearing an external circle of 24 long tentacula which are pale fulvous, and a few (about six) shorter white ones outside of them ; also an inner circle of two or three-ranked short white tentacula (50 or 60) surrounding the mouth, which is transverse at the bottom of a brown funnel-shaped cavity in the centre of the circle of shorter tentacula. Tentacula retractile. Base not expanded. Animal sluggish, and when contracted and not attached, looking more like a planarian worm than an Actinia. Body $0\frac{8}{12}$ long : larger tentacula $0\frac{2}{24}$.

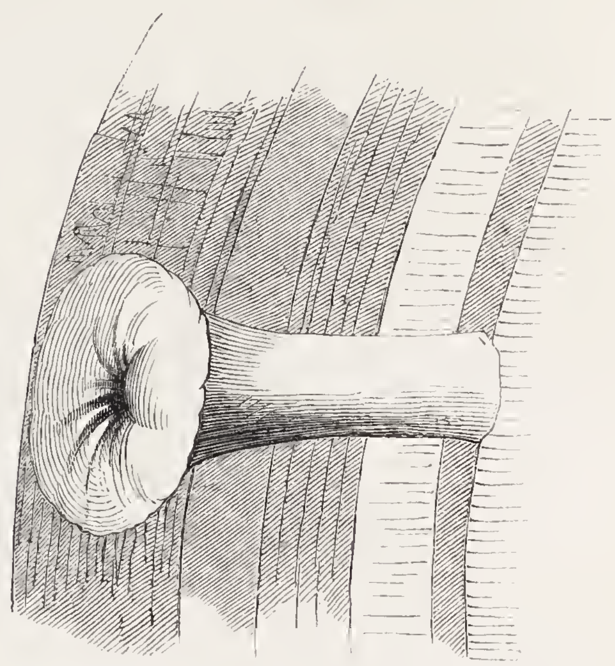
"Gives out a vivid phosphorescent light when irritated in the dark." *E. Forbes.*

† † Skin with porous warts.

Obs.—This section corresponds with the genus CRIBRINA of Ehrenberg, which I have not adopted, because the value of the character on which it rests is yet to be tested. Of one species I have mentioned that it has both warted and smooth varieties, and I have seen individuals which were glandular on one side of the body and smooth on the other. But recent observations cast a doubt on the accuracy of these statements, for I now know that an individual apparently quite smooth on being taken from its habitat can, and does, become warted when placed in a basin of sea-water. I have repeatedly seen this change, produced evidently by a protrusion of the warts which had been hidden in the mucous skin. The

warts are all perforated, so that water contained in the body, as well as the seminal filaments, are often ejected through them. Mr. Cocks is convinced "that the apertures on the body have nothing anatomically to recommend them to a notch on the tubercular tally. They are simple tubes with a trumpet-like base externally, passing between the muscular fibres to the ovarian chambers (Fig. 50), for the supply of water and air in shallow pools, or channels for the exit of the ova. They form the points of adhesion for all the stones, shells, and sand, which cover the body, and are, therefore, suctorial."

Fig. 50.



14. A. GEMMACEA, *body conoid, cylindric in extension, with the glands in distinct rows extending from the disc to the base; tentacula whitish, variegated.* Gærtner.

PLATE XXXVIII. FIG. 6—9.

Ortie de mer, *Reaumur* in Mem. de l'Acad. Roy. des Scienc. 1710, pl. 10, fig. 21, 23-26.—Hydra disciflora, tentaculis retractilibus subdiaphanis; corpore cylindrico, miliaribus glandulis longitudinaliter striato, *Gærtner* in Phil. Trans. lii. 82, tab. 1, fig. 4; copied in Encyclop. Method. Vers. pl. 70, fig. 4. Phil. Trans. abridg. xi. 529.—Hydra gemmacea, *Stew.* Elem. ii. 451.—Actinia gemmacea, *Ellis* and *Soland.* Zooph. 3. *Turt.* Gmel. iv. 104. *Turt.* Brit. Faun. 131. *Jameson* in Wern. Mem. i. 558.—Act. verrucosa, *Penn.* Brit. Zool. iv. 103. *Berk.* Syn. i. 186. *Lam.* Anim. s. Vert. iii. 70. *Stark* Elem. ii. 412. *Rapp* Polyp. 50.—Act. glandulosa, *Bosc* Vers ii. 259. *Rapp's* Polyp. 52.—Cribrina verrucosa, *Ehrenb.* Corall. 40.

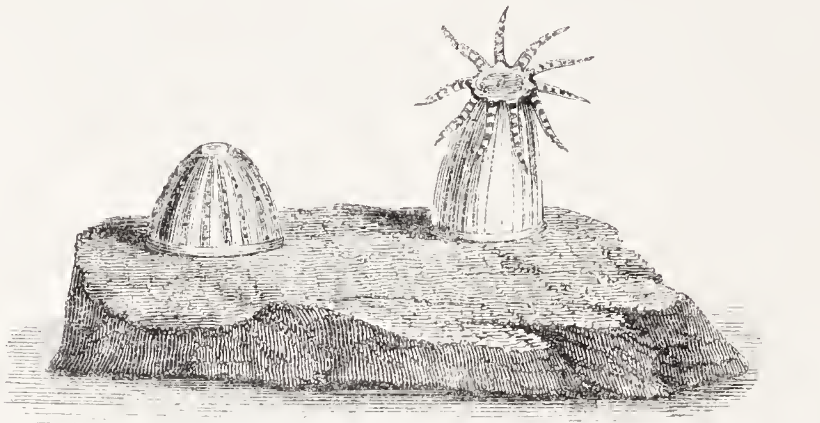
Hab.—Coast of Cornwall, *Gærtner.*

"The colour of the stem is of a pale red near the base, the rest of a yellow, mixed with grey ash colour. The glands of the middle row are white, the rest of the same colour with the stem. The feelers are of a whitish colour, varied at the upper part with several cross lines and brown spots of an irregular figure, like the backs of some snakes." *Ellis.*

15. A. MONILE, "*with a cylindrical body of a light cinereous green, marked with from* 14 *to* 16 *lines of bead-like tubercles; the circumference of the disc is also striated, and with a single range of variegated tentacula.*" J. Templeton.

Actinia monile, *Templeton* in Loud. Mag. N. Hist. ix. 303, fig. 49.

Fig. 51.



Hab.—"Rare: a few specimens were found on the shore of Belfast Lough, near Holywood, April, 1803," *J. Templeton.*

"They were, when contracted, scarcely larger than a pea, and had only ten tentacula. Perhaps the young of a larger species." *J. Templeton.*

16. A. CORIACEA, *body conoid, orange-coloured, blotched, rough with large perforated warts; tentacula numerous, in three or four series, shorter than the diameter of the disc, thick, annulated, with coloured rings; rim of the oral disc circular and even.*

PLATE XXXIX. Fig. 1, 2.

L'Actinie coriace, *Cuv.* Reg. Anim. iii. 291.—Actinia coriacea, *Rapp* Polyp. 51. tab. 1, fig. 3, 4. *Teale* in Trans. Leeds Soc. i. 91, pl. 9, 10, and 11.—Act. senilis, *Flem.* Brit. Anim. 498.—Act. gemmacea, var. β. *Johns.* Brit. Zooph. 213, pl. 27. *Couch* Corn. Faun. iii. 76.—Cribrina coriacea, *Ehrenb.* Corall. 40.—Act. digitata? *Mull.* Zool. Dan. iv. 16, tab. 133.

Hab.—Between tide-marks, buried in crevices of rocks and in sand, common. "Generally located in a sandy situation in crevices between shelving rocks, or under a projecting portion of rock in a sheltered situation with a sandy bottom," *W. P. Cocks.*

Body conoid or semi-globose, with a circular base about two inches in diameter, variously coloured, usually dull red, blotched with green; skin opake and coriaceous, covered with numerous pale sub-diaphanous warts, often so close together that they appear irregular,

but it can occasionally be seen that they are arranged in distinct rows ; rim of the oral disc thick, even, and prettily crenated with small glands ; the disc itself smooth, lineated, blotched with red and olive, or sometimes entirely olivaceous; the lips of the mouth turgid; tentacula very numerous, subequal, conical, obtuse; when fully extended about one-third of the diameter of the disc in length, smooth, prettily marked with red and olive rings, and often with white blotches on one side near their roots. "The base of each tentaculum is embraced by two red, and the inner row also by two white lines, which converge on either side and cross the oral disc on the one hand, and pass between the bases of the tentacula on the other." *R. Q. Couch.* These organs are in four irregular circles, those of the innermost series being few in number, distantly placed, rather larger than the others, and held either erect or bent inwards to the mouth when the creature is at ease and in full blow.

Actinia coriacea is somewhat gregarious. It buries itself in sand and in crevices of rocks between tide-marks, concealing itself with a coating of gravel, which is retained by the aid of the glandular warts. I have sometimes found that specimens, when newly removed from their sites and cleansed, were apparently smooth, but on being kept in pure sea-water, the glands became afterwards visible and as large as usual.* The animal has not the capacity of dilating the body to a bladdery and subdiaphanous extent. When contracted, it must be sought for to be seen, but, in a state of expansion, the floral beauty of its tentaculated disc makes it sufficiently conspicuous and attractive. "On one occasion," says Mr. Couch, "while watching a specimen that was covered merely by a rim of water, a bee, wandering near, darted through the water to the mouth of the animal, evidently mistaking the creature for a flower, and though it struggled a great deal to get free, was retained till it was drowned, and was then swallowed."

Mr. Cocks is certain that the *Actinia monile* is the young of this species ; and I am inclined to believe that *Act. troglodytes* is also its young in a more advanced stage. But as I cannot adduce sufficient proof of this belief, it seems better to describe the three as distinct until more positive information is obtained ; and it will be remarked that they are well defined by their specific characters.

* "I have frequently found the skin perfectly smooth, not the slightest indication of tubercles or ducts, until the creature was irritated to complete contraction."—*W. P. Cocks.*

17. A. crassicornis, *body conoid, variously coloured, rough with glandular warts ; tentacula numerous, in three or four series, shorter than the diameter of the oral disc, thick, and generally variegated with red and white rings ; a dark spot on each side of the mouth in the medial fissure ; rim of the border uneven.*

Plate XL.

L'Ortie rouge, *Rondel.* Poiss. i. 381-2.—Priapus sive Actinia proboscidibus crassis rotundis, *Bast.* Opusc. Subsc. i. lib. iii. 143, tab. 13, fig. 1.—Act. felina, *Lin.* Syst. 1088. *Barbut* Gen. Verm. 53, tab. 5, fig. 6.—Act. senilis, *Dicquemare* in Phil. Trans. lxiii. 367, tab. 16, fig. 10 : and tab. 17. fig. 11, 12. *Johnston* in Trans. Newc. Soc. ii, 245 (pelagic varieties). *Templeton* in Mag. Nat. Hist. ix. 303.—Actinia crassicornis, *Mull.* Zool. Dan. prod. 231. *Adams* in Lin. Trans. iii. 252. *Jameson* in Wern. Mem. i. 558. *Stew.* Elem. i. 393. *Lam.* Anim. s. Vert. iii. 67 : 2de edit. iii. 407.—Act. holsatica, *Rathke* in Mull. Zool. Dan. iv. 23, tab. 139.—Act. equina, *Sowerby* Brit. Misc. 7, pl. 4.—Act. bimaculata ? *Grube* Actin. 4, fig. 4.

Hab.—On old shells and stones from deep water, very common. On some shores it is also a littoral species, when it is "generally attached to the side of the rock in crevices, or on the face of clean stones in sheltered situations," *W. P. Cocks.*

This fine species resembles the Act. coriacea in shape, but it attains a larger size, is less coriaceous, more variously and vividly coloured, and the warts of the skin are smaller and more scattered, and sometimes they are scarcely or not at all obvious ; but, as Mr. Cocks has remarked, the most distinctive character of A. crassicornis is the readiness with which the rim of the peristomatous disc can be thrown into undulations or twisted awry ; to which I would add the ready ease with which the body is filled with water until it becomes bladdery and diaphanous. The tentacula are disposed within the circumference of the oral disc, in three or four close rows ; they are thick, short, obtuse, somewhat compressed, almost always annulated or variegated with white and red, but when the body is of a uniform pale, flesh, or cream colour, the tentacula are of the same colour and without rings. The animal protrudes from the mouth at pleasure four or five vesicular, pellucid, scored lobes, which vary in size according to their degree of evolution, and often hang over the sides. When kept for a few hours in a basin of sea-water, it becomes much larger in all its parts, paler, and almost diaphanous ; and the tentacula elongate themselves, swell out, and are distinctly seen to be tubular.

Actinia crassicornis never indues itself with an extraneous covering. It is very sportive in its colours, and some of the varieties are eminently beautiful. One is of a uniform bright scarlet studded over with pale warts like ornamental beads; another is of a cream colour without spot or stain; another is of a pale sulphur-yellow, or greenish with orange-coloured stripes, the oral disc and vesicular lobes borrowing the hues of the wild rose; another is blotched or marbled with red and white; but indeed they vary in this respect so much that no description can do justice to them or define their limits. The species varies, too, in its wartiness;—in some individuals the warts are small and often obscure, and in others the body is quite smooth,—a variety which constitutes the A. felina of Linnæus, if we are to be guided, in the identification of his species, by the figures to which he refers, for I am quite aware that neither the specific character nor trivial name are applicable.—Is it the *Isacmaea crassicornis* of Ehrenberg? Corall. p. 33.—The *Isacmaea papillosa* (Corall. p. 33.) of the same distinguished naturalist is more certainly founded on our scarlet wart-studded variety of A. crassicornis.—The Act. crassicornis of Delle Chiaje (Anim. s. Vert. Nap. pl. 16, fig. 4.), is a different species; as is also the Actinia described under the same name by the excellent author of the Fauna Groenlandica, p. 348.

Dicquemare says—"Of all the kinds of Sea-Anemonies, I would prefer this for the table; being boiled some time in sea-water, they acquire a firm and palatable consistence, and may then be eaten with any kind of sauce. They are of an inviting appearance, of a light shivering texture, and of a soft white and reddish hue. Their smell is not unlike that of a warm crab or lobster." Phil. Trans. abridg. xiii, p. 637.—The mouth waters at the liquorish description, and I dare to say that Sea-Anemonies are not less a luxury than the Sea-Urchins of the tasteful Greeks, or the snails of the Roman epicures, but I have not been tempted to test its truth. Rondeletius, having, as I think, Actinia crassicornis in view, is an older witness to its daintiness, and he tells us that it brings a good price at Bourdeaux: "ilz la lauent fort é souuent, puis la fricassent legierement en la poele."—Actinia dianthus also "is good to eat," quoth Dicquemare; and Plancus directs the cook to dress this after the manner of dressing oysters, with which it is frequently eaten. Even the hot and peppery Anthea has its praise; from it they prepare the dish called *Rastegna*, which is a favourite in Provence.

18. A. PARASITICA, "*body cylindrical; skin coriaceous, sprinkled with minute warts; tentacula short, in six or seven series, varied.*" R. Q. Couch.

PLATE XLI.

La quatrieme espece d'Ortie, *Rondel.* Poiss. i. 332, fig.—Actinia effoeta, *Rapp* Polyp. 54, tab. 2, fig. 2.—Act. parasitica, *Couch* Zooph. Cornw. 34: Corn. Faun. iii. 80, pl. 15, fig. 1, 2.

Hab.—Coast of Cornwall. "The favourite site for them is on the claw of the corwich crab (M. verrucosa)," *R. Q. Couch.* In the neighbourhood of Falmouth never found on this crab nor on Pinna ingens, but frequently on Pecten maximus, Buccinum undatum, and on stones, *W. P. Cocks.*

"The body, when the animal is expanded, is columnar, with a hard coriaceous skin, sprinkled with minute warts. The tentacula are about one-third the diameter of the oral disc, rather slender; mouth generally elevated into a cone. This may probably be considered a variety of the Actinia gemmacea, as that kind is liable to so many variations, but it had not the appearance of belonging to that species." *R. Q. Couch.*

Rapp considers this to be the *Actinia effoeta* of Linnæus, and the *Actinia brune* of Cuvier; but Baster's figure (Opusc. Subs. 143, tab. 14, fig. 2.) quoted by Linnæus, represents an apparently different species; and Cuvier's description does not agree well with that given by Rapp himself, nor with that of Mr. Couch.

The *Actinia effœta* mentioned in systematic works on British Zoology is referable sometimes to *Act. crassicornis,* and sometimes to *Adamsia maculata.*

19. A. BELLIS, "*body lengthened, the lower part narrow, smooth, the upper enlarged and glandularly warty; oral disc expanded, lobed; tentacula in several rows, variegated.*" Gærtner.

PLATE XLII. FIG. 1.

Hydra calyciflora, tentaculis retractilibus variegatis; corpore verrucoso, *Gærtner* in Phil. Trans. lii. 79, tab. 1, fig. 2. Phil. Trans. abridg. xi. 527.—Actinia bellis, *Ellis* and *Soland.* Zooph. 2. *Rapp's* Polyp. 50, tab. 1, fig. 1, 2. *Turt.* Gmel. iv. 103. *Turt.* Brit. Faun. 131. *Hassall* in Ann. and Mag. Nat. Hist. vii. 285.—Actinia Templetonii, *Couch* Corn. Faun. iii. 80.—A. pedunculata, *Pen.* Brit. Zool. iv. 102. *Berk.* Syn. i. 186. *Lam.* Anim. s. Vert. iii. 70: 2de edit. iii. 411. *Bosc* Vers. ii. 258. *Stark* Elem. ii. 412. *Flem.* Brit. Anim. 498. *Templeton*

in Mag. Nat. Hist. ix. 303.—Hydra bellis, *Stew.* Elem. ii. 451.—Cribrina bellis, *Ehrenb.* Corall. 41 ; and in *Lam.* Anim. s. Vert. 2de edit. iii. 425. *Grube* Actin. 12.

Hab.—"Frequently found in the pools about the Mount's Bay," Cornwall. "It is rare to meet with a single one in a place, there being most commonly four or five of them living so near together in the same fissure of the rock, which they constantly inhabit, that their expanded calyces form a row of flower-like bodies, that seem to grow upon the cliffs under water," *Gærtner.* "Found in a pool on the rocks at the north end of the Island of Rathlin, August 1795," *Templeton.* Ballyhome Bay, co. Down, *W. Thompson.*

"From its small basis rises a cylindric stalk, which supports the roundish body of the animal, from whence afterwards the calyx, being a continued membrane of the body, draws its origin. The stalk, or the pedunculus of the polype, is quite smooth, and its colour inclines towards the carnation. The outside of the calyx, and the body of this animal, are marked with a number of small white protuberances, resembling warts, to which fragments of shells, sand-grains, &c. adhere, and hide the beautiful colour of these parts, which, from that of carnation, is insensibly changed towards the border of the calyx first into purple, then violet, and at last into a dark brown. The inside of the calyx is covered with the feelers, that grow in several ranges upon it : they differ considerably in length ; those that are near the edge of the calyx being but small papillæ, in proportion to those that surround the disk, or the central part of the body. They are almost transparent ; and some of them are of a pale ash colour, with brown spots ; others, on the contrary, are of a chesnut colour, marked with white spots. The disk is formed like a star, which, according to the figure that is traced out by the innermost row of the feelers, consists of many angles. The colour of this part of the body is a beautiful mixture of brown, yellow, ash-colour and white, which together form variegated rays, that from the centre, or the mouth of the animal, are spread over the whole surface of the disk.—This polype contracting itself, changes its body into an irregular hemisphere, which is so covered with the several extraneous bodies that stick to it, that it is extremely difficult to know the animal in this state, and to discern it from the rubbish, that commonly surrounds it," *Gærtner.*

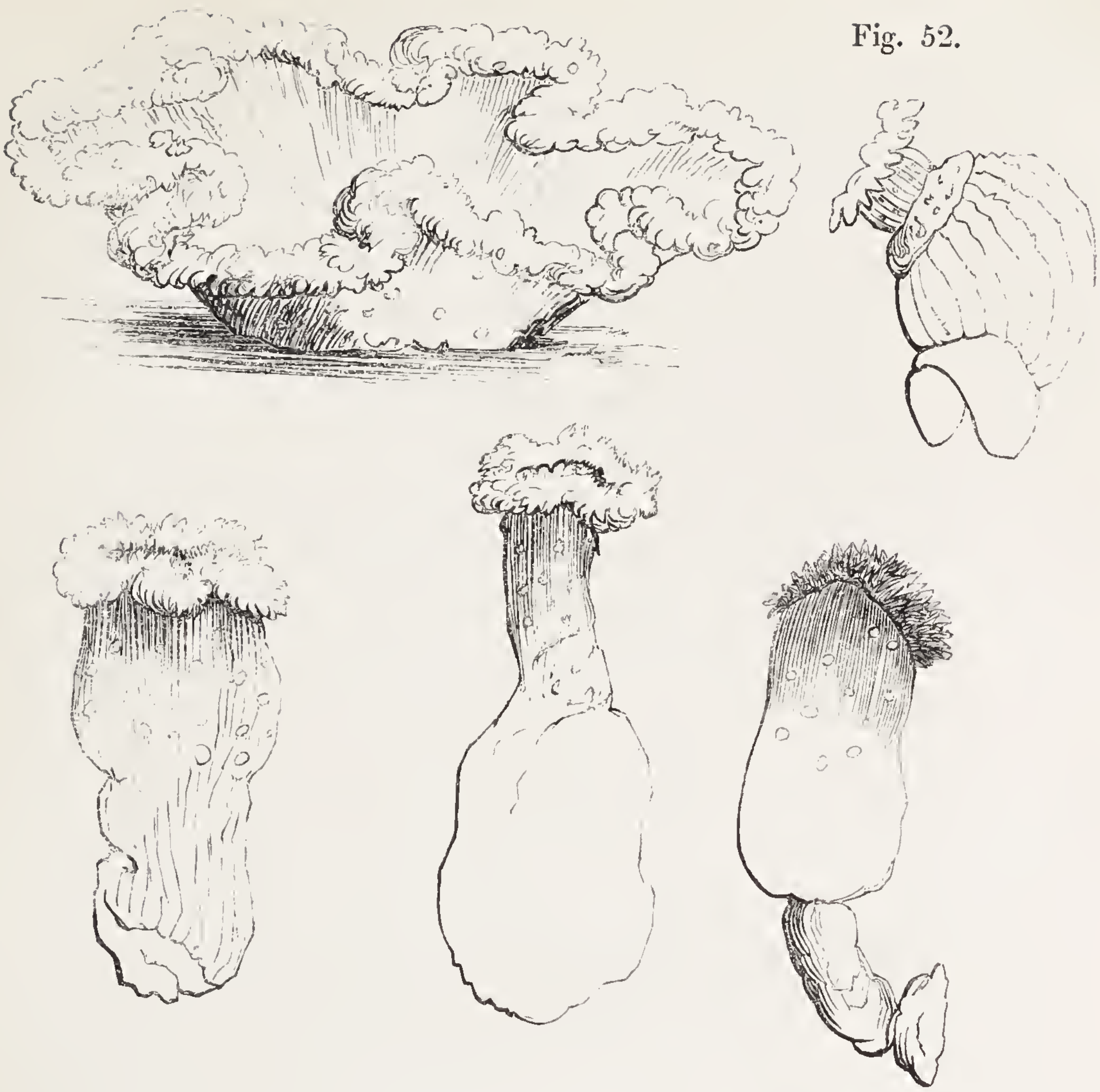
"This beautiful species is certainly no variety of *Actinia gemmacea*, as has been supposed by some from the perusal of Gærtner's description of it. It inhabits the fissures of rocks, in which the whole of

the body of the polypus is concealed, the expanded cup-like head alone being visible above the margin of the fissure. The body is often lengthened to the extent of two inches; its basis is contracted, but gradually widens upwards towards the calyx; the lower portion of it is nearly colourless, higher up it becomes of a flesh colour, this changing into a greenish brown, of which it continues up as far as the feelers. The upper half of the body is covered with numerous small white glands, which possess great powers of suction. The diameter of the calyx, which is somewhat cupped, in the larger specimens often exceeds two inches; its margin does not describe a perfect circle, but is variously festooned. The colour of the disc is dark brown, ornamented with broad bands of opaque white, and finely streaked and dotted with light yellow. The feelers are very small, placed on the edge of the calyx in several rows, to the depth of one-third of an inch; those nearest the disc, also, are about one-third of an inch in length, and are the longest, the outermost tentacula being but little more than papillæ; they are of a lighter brown than the disc, and are variegated with transverse bands and spots of white. The shades of brown in the different parts of each *Actinia* vary considerably with the specimens.

"Found in a clear pool, opposite Dalkey Island, but little below high-water mark, the only locality in which I have ever met with it; and what is not a little peculiar is, that it is confined to that one pool, although there are others in its immediate vicinity apparently equally suitable for it." *A. H. Hassall.*

Mr. Cocks remarks, on Gærtner's figures, that they are sketched from a specimen deprived of liberty and its regular supply of water: the first figure represents the body elongated and the tentaculiferous disc expanded, a very common state of this species in confinement, when the outer rows of tentacula are frequently found horizontally placed, while those of the innermost row are in nine cases out of ten held erect: in Gærtner's second figure the disc is partially contracted, with fragments of shells and sand attached to the aperture, as it is found commonly on the sea-shore, but the extraneous gravel is soon cast off in confinement. The species is in fact very Protean, and within the space of an hour will assume a great variety of shapes, some of which are shown in the annexed wood-cut (fig. 52), selected from a series of drawings sent me by Mr. Cocks. Under every shape, however, the species seems to be readily distinguishable by the lobed or festooned margin of the disc, the tubercular state of the superior half of the body, and the arrangement of its very numerous tentacula.

Fig. 52.



It is a littoral species, and the commonest of its genus on the coast of Cornwall, where it is generally found in crevices in pools, the bottom of which is covered with Corallinæ and Nullipores, &c. Yet it will sometimes forsake these "wells of pure water" for what is little better than a Stygian bog." March 14, 1846. "This morning," writes Mr. Cocks, "I visited the beach L. W. M., back of Mr. Sulley's Hotel, Green Bank; it is composed of mud, sand, and decomposed algæ,—many of the stones, when lifted, presented a face as black as the skin of an African, and sent forth a rich aroma of sulphuretted hydrogen. It is thickly studded with stones varying in size and weight, from two ounces to thirty pounds. There are a few remnants of stunted rocks thinly scattered, from four to eight inches high,—these are covered with Fucus vesiculosus and serratus. In turning the stones over, I was astonished to find in this Pandorian locality, herds of the Actinia bellis in prime condition,—jackets as red as a Kentish cherry,—tubercles on external portion of the disc light neutral tint, and strongly marked. So pugnacious, that, when touched, water issued in full streams from nearly all the ducts or

apertures: one sent forth his seminal filaments in company with the limpid stream. The ground is literally covered with them. The oral disc and tentacula present a variety of tints,—dark brown,—light fawn,—dark and light ochre,—cream, &c.—all the tentacula (one excepted) are annulated. I have fourteen individuals in my experimental bottles,—each of them has the ochre-coloured or white tentaculum (nearly one-third larger than any of the others) making one of the central row; and a white or buff mark or line extends from it to the angle of the mouth on each side."

The *Actinia bellis* of Professor Forbes in Ann. of Nat. Hist. v, p. 182, may prove to be a distinct species. "The body is cylindrical, of a reddish or reddish-white colour, regularly and finely striated longitudinally and transversely, and having glands of a bright yellow colour, small and not very numerous, scattered over the surface. At the oral end the body bulges, forming a calyx, on which the furrows are fewer but more granulose. When the disc is expanded, this calyx laps back, and is then almost even with the expanded tentacula. Disc angular, in my specimens square, surrounded by three or four rows of short tentacula, thickly set, of a white or brownish colour, variegated, having generally a white line down the centre of each. The disc is broad, brownish or orange, with white lines. The margin of the mouth is bright orange. The animal can project its disc forward in a pouting manner. Tentacula and disc are retractile. The specimens described were about one inch long when expanded, but I have seen larger." *E. Forbes.*—My accomplished friend permits me to illustrate this description with figures copied from his drawings.

The *Actinia bellis* of Mr. Couch (Corn. Faun. iii. p. 76) is apparently a variety of Act. coriacea; and there can be no hesitation in referring his *Act. Templetonii* to the true Act. bellis.

20. A. DIANTHUS, *body cylindraceous, smooth; oral disc marked in the centre with clavate radiating bands; tentacula numerous, irregular, the outer small and forming round the margin a thick filamentous fringe.* Ellis.

PLATE XLIII.

Urtica soluta caryophyllum referens, *Planc.* Conch. 43, tab. 4, fig. 6.—Priapus sive Actinia proboscidibus tenuibus brevibus, *Bast.* Opusc. Subsec. i. lib. 3, 143, tab. 13, fig. 2-4 (bene).—Actinia senilis, *Lin.* Syst. 1089.*—Act. judaica, *Lin.* Syst.

* Linnæus quotes two *distinct* figures of Baster for his senilis; but as he subse-

1088.—Actinia Dianthus, *Ellis* in Phil. Trans. lvii. 436, tab. 19, fig. 8: copied in Encyclop. Method. Vers, pl. 71, fig. 5. *Ellis* and *Soland.* Zooph. 7. *Shaw* Nat. Misc. xiii. pl. 539: (copied from Ellis and coloured from the description!) *Turt.* Gmel. iv. 104. *Turt.* Brit. Faun. 131. *Stew.* Elem. i. 394. *Flem.* Brit. Anim. 498.—Fourth species of Anemony, *Dicquemare* in Phil. Trans. abridg. xiii. 638, pl. 12, fig. 9.—A. pentapetala, *Penn.* Brit. Zool. iv. 104. *Berk.* Syn. i. 187. *Lam.* Anim. s. Vert. iii. 71: 2de edit. iii. 412. *Bosc* Vers, ii. 259—Actinoloba dianthus, *Blainv.* Actinol. 322.—A. plumosa, *Mull.* Zool. Dan. prod. 230; no. 2791. Zool. Dan. iii. 12, tab. 88, fig. 1, 2 (drawn when the animal has been in a very relaxed and half-expanded condition), and fig. 4. *Turt.* Gmel. iv. 100. *Turt.* Brit. Faun. 130. *Stew.* Elem. i. 394. *Lam.* Anim. s. Vert. iii. 68: 2de edit. iii. 407. *Bosc* Vers, ii. 256. *Stark* Elem. ii. 412. *Cuv.* Reg. Anim. iii. 291. *Rapp* Polyp, 55, tab. iii. fig. 1 (good). *Johnston* in Trans. Newc. Soc. ii. 246. Micros. Journ. ii. 147.—La Métridie plumeuse, *Blainv.* Actinol. 321.—A. senilis, *Barb.* Gen. Verm. 53, tab. 5, fig. 5. *Adams* in Lin. Trans. v. 9. *Lam.* Anim. s. Vert. iii. 68. *Stark* Elem. ii. 412. — Hydra dianthus, *Stew.* Elem. ii. 451.— Act. dianthus, *W. Thompson* in Ann. Nat. Hist. v. 251.

Hab.—On rocks and shells in deep water or within low tide-mark.

When contracted the body is of a thick short subcylindrical form, deeply wrinkled in two or three places, about three inches long, and one-half of that in diameter, but when fully expanded about five inches: the skin is smooth, and of a uniform olive, whitish, cream or flesh-colour. The centre of the oral disc is ornamented with a circle of white bands radiating from the mouth, and the transparency of the skin here permits us to see the lamellæ running across the circumference with their narrow colourless interspaces. From these interspaces the tentacula originate; the largest about one inch long, watery, white, tapered, smooth, irregularly dispersed, and very numerous. They are all placed between the mouth and the margin, which is encircled with a dense fringe of inimitable beauty, composed of innumerable short tentacula or filaments forming a thick furry border.

I have seen specimens of this species, which is certainly as Müller says "actiniarum pulcherrima," from the size of a split pea to fully five inches in diameter, and have found it, in all the intermediate sizes, uniform in shape and colour. It is strictly gregarious, and the larger individuals are generally surrounded by a multitude of small and middle-sized ones, which form very pleasing groups. From this gregarious habit it is subject to monstrosities; two or three occasionally uniting and coalescing into one body, of which Dicquemare

quently refers to one of these figures for his effœta, the other (tab. 13, fig. 2.) must be considered as representing the true senilis.

has described an example. Mr. Cocks has sent me a sketch of an individual that had two mouths of equal size and perfection.

As A. dianthus is a permanently attached species, and cannot be removed from its site without organic injury to the base, it has some claim to be made the type of a genus.

It is very possible that one or more species nearly related to A. dianthus may have been hitherto confounded with it. My own experience would lead me to believe, with Cuvier, that the dianthus is unicolorous, and I must have seen several hundreds of individuals,—hence a suspicion that what has been described as a variety with a chesnut-brown body, and barred and variegated tentacula, (*Couch*, Corn. Faun. iii, p. 79.) may possibly have other characters also of a higher and specific value. Our dianthus is a deep-water species, while the presumed coloured variety is found between tide-marks.

From want of sufficient information relative to their characters, I purposely omit the following species: 1. Actinia truncata, *Jameson* in Wern. Mem. i, 558. *Penn.* Brit. Zool. iv. 106. *Turt.* Gmel. iv. 101. *Turt.* Brit. Faun. 131.—2. Act. sulcata, *Templeton* in Loudon's Mag. Nat. Hist. ix. 303. Templeton says that this is "most probably the young" of the A. effœta, but I do not know what species he intends under the latter name. Can his *sulcata* be really the effœta of Linnæus? Of this all the description which Baster gives is: "Directas illa habet in corpore strias, et inferne basin, sive marginem, qua se affigit."—3. Act. caryophillus, *Stew.* Elem i. 394. *Turt.* Gmel. iv. 103. *Penn.* Brit. Zool. iv. 106. Introduced on the authority of "Martin's Marine Worms," a work apparently very rare, and which I have been unable to procure. It may possibly be synonymous with A. dianthus.—4. Act. anemonoides, *Turt.* Gmel. iv. 101. Act. anemone, *Penn.* Br. Zool. 106. Quoted from Shaw's Naturalist's Miscellany, tab. 26, 27.—The Actinia anemone of Ellis is a West Indian species.

Observations.

The Actiniæ adhere to rocks, shells, and other extraneous bodies by means of a glutinous secretion from their enlarged base; but they can leave their hold and remove to another station whensoever it pleases them, either by gliding along with a slow and almost im-

perceptible movement,* as is their usual method; or by reversing the body and using the tentacula for the purpose of feet, as Reaumur asserts,† and as I have once witnessed; or lastly, inflating the body with water to render it more buoyant, they detach themselves and are driven to a distance by the random motion of the waves.‡ They feed on shrimps, small crabs, whelks, and similar shelled mollusca, or, probably with indifference, on whatever animals are brought within their reach, and whose strength or agility is insufficient to extricate them from the grasp of their numerous tentacula; for as these organs can be inflected in any direction and greatly lengthened, they are capable of being applied to every point, and adhere by suction with considerable tenacity.§ The food is retained in the stomach for ten or twelve hours, when the undigested remains are regurgitated, enveloped in a glairy fluid, not unlike the white of an egg. The size of the prey is frequently in unseemly disproportion to the preyer,|| being often equal in bulk to itself. I had once brought me a specimen of Act. crassicornis, that might have been originally two inches in diameter, and that had somehow contrived to swallow a valve of Pecten maximus of the size of an ordinary saucer. The shell, fixed within the stomach, was so placed as to divide it completely into two halves, so that the body, stretched tensely over, had become thin and flattened like a pancake. All communication between the inferior portion of the stomach and the

* Reaumur found that they require an hour to advance one or two inches; but I have seen A. mesembryanthemum advance at a rate considerably quicker—half an inch in about five minutes.

† Mem. de l'Acad. Roy. des Sc. 1710, p. 621.

‡ "An Actinia, in my possession, walked up the sides of a glass, by alternately adhering with its disc and base in the Leech-fashion. I observed that a Mediterranean Actinia, which is habitually free, swims by contractions, in the manner of a Medusa. When confined in a glass, it attached itself to the sides by its base, just like a shore-actinia."—*Professor Edw. Forbes.*

§ According to Gærtner, the animal fixes the tentacula by throwing out of their whole surface "a number of extremely minute suckers, which, sticking fast to the small protuberances of the skin, produce the sensation of a roughness, which is so far from being painful, that it even cannot be called disagreeable." Phil. Trans. v. 52, p. 76.—No such structure can be discovered.

|| "Fauces hæc animalia, subtus sacci instar penitus clausa, superne habent pro libitu tam patulas, ut mytulos satis magnos aliasve conchas ingurgitent, e quibus, modo nos fugiente, pisces extrahere, et evacuatas testas per eandem aperturam, ejicere rursus valent. Quæ testæ, si majores sint, et ægre per fauces transituræ essent, Priapus non solum fauces late expandit, sed easdem, ut solemus tibialia, quasi invertit, quo spatium brevius et apertura fit latior." Basteri Opusc. Subsec. i. lib. iii. 122.

mouth was of course prevented, yet instead of emaciating and dying of an atrophy, the animal had availed itself of what undoubtedly had been a very untoward accident, to increase its enjoyments and its chances of double fare. A new mouth, furnished with two rows of numerous tentacula, was opened up on what had been the base, and led to the under stomach :—the individual had indeed become a sort of Siamese twin, but with greater intimacy and extent in its unions !

The existence of nerves in the structure of the Actiniæ is still doubtful. Spix tells us, that he detected near the base and centre of the body some small nodules or ganglions placed in pairs, from which filaments emanate towards the circumference, constituting, as he believes, their nervous system. Blainville asserts, however, that in numerous dissections made with every possible care, he could see nothing like what Spix has described and figured ; and the only part that he can regard as nervous, is a sort of grey pulpy cord in the margin of the labial rim. Delle Chiaje and Mr. Teale agree with Blainville.* Be the fact as it may, we know that every part of the body is very sensible to external irritations : no point of the skin, the tentacula, nor the membrane of the stomach can be touched, but immediately the creature evidences its sense of the injury by contractions and other motions of the part. They are said also to be very sensible of atmospherical changes : they shrink under a glare of light ;† but in a calm and unclouded sky expand and disclose every beauty, while they remain contracted and veiled in cloudy or stormy weather. Dicquemare has even found, from several experiments, that they foretell changes in the weather as certainly as the barometer. When they remain naturally closed,

* But Dr. Grant says — "The nervous system has been long known in the Actinia."—"Nervous filaments surround the muscular foot of the Actinia, beneath the stomach, and present minute ganglia in their course, from which nerves pass out to the circumference, and to the muscular folds which here possess great power of contraction. The same system probably exists in many other closely allied forms of polypi." Outlines of Comp. Anat. p. 182.

† It has been suggested that their perception of light may be communicated through the tentacula, on the tips of which, Bosc assures us, there is a black point or *eye*. Vers, vol. ii. p. 247. This black point, as well as the other parts of Bosc's description of the tentacula, is wholly imaginary ; nor is there a necessity for an eye to explain the phenomena, for there can be "little doubt that a diffused sensibility to light and sound exists in animals which present no special organs of vision or hearing." Brit. and Foreign Med. Rev. v. p. 491.—I have already mentioned that the coloured spot on each side of the mouth, in the commissure of the stomachical membrane, is a visual organ in the opinion of Mr. Cocks.

there is reason to fear a storm, high winds, and a troubled sea; but a fair and calm season is to be anticipated when they lie relaxed with spread-out tentacula.*

That the Actiniæ are viviparous is very commonly alleged, and almost every naturalist who has paid attention to their habits may be quoted as a witness of the escape of the young from the stomach through the oral aperture.† Some have maintained that these

* Dicquemare's observations seem of sufficient interest to justify their insertion at length. He says—"My very earliest observation showed that the sea anemonies feel and prognosticate, within doors, the different changes of temperature in the atmosphere. I had not leisure at that time to form tables of their various indications, but I have since done it. This fact, if applied to practice, might be of use in the formation of a sea-barometer, an object of no small importance, which several ingenious men have hitherto endeavoured in vain to furnish us with. I should prefer the anemonies of the third species for this purpose, their sensation being very quick; they are also easily procured, and may be kept without nourishment. Five of them may be put in a glass vessel, four inches wide and as many in depth, in which they will soon cleave to the angle formed by the sides and the bottom. The water must be renewed every day, and as they do not require a great quantity of it, as much may be fetched from the sea (if they be kept on land) as will supply them for several days; its settling some time will only improve it. If the anemonies be at any time shut or contracted, I have reason to apprehend an approaching storm—that is, high winds and an agitated sea. When they are all shut but not remarkably contracted they forebode a weather somewhat less boisterous, but still attended with gales and a rough sea. If they appear in the least open, or alternately and frequently opening and closing, they indicate a mean state both of winds and waves. When they are quite open, I expect tolerable fine weather and a smooth sea. And lastly, when their bodies are considerably extended, and their limbs divergent, they surely prognosticate fixed fair weather and a calm sea. There are times when some of the anemonies are open and others shut; the number must then be consulted; the question is decided by the majority. The anemonies used as barometers should not be fed, for then the quantity of nourishment might influence their predictions. Anemonies of this and of the first species live and do well for several years without taking any other food but what they find disseminated in the sea-water; but should a respite of some days be granted them, they might then be fed with some pieces of muscles of soft fish, and thus restored to their original vigour. Whenever the vessel is sullied by the sediments of salts, slime, the first shoots of sea-plants, &c., it may on changing the water be cleansed by wiping it with a soft hair pencil, or even with the finger, carefully avoiding to rub or press hard on the anemonies. Should any of them drop off during this operation, they may be left at liberty, for they will soon of their own accord fix themselves to some other place. Should any of them die, which will soon be discovered by the milky colour of the water, and an offensive smell on changing it, it must be taken out, and on the first opportunity another of the same species be put in its place; those of a moderate size are the most eligible." Dicquemare in Phil. Trans. abridg. xiii. 642-3.

† "Leur génération ordinaire est vivipare. Les petites actinies passent de l'ovaire dans l'estomac et sortent par la bouche." Cuvier, Reg. Anim. iii. 291.

young may have been swallowed accidentally by the supposititious mother, and being found unfit for digestion are consequently rejected, quoting in favour of this not very feasible conjecture, an experiment of Dicquemare, who, offering several small individuals to a larger one of a different species, found that it swallowed them readily, "but threw them up again alive within eight, ten, or twelve hours, or even later." Dicquemare himself, although he expresses himself in dubious terms, evidently believed them to be viviparous, having seen several bring forth even in his hand, eight, ten, or twelve young ones like to their parents in all but size, and which immediately affixed themselves, and began to stretch their tentacula as if in quest of prey. Ellis was of the same belief;* and Sir J. G. Dalyell, the best authority on the subject, also says that they are viviparous. "The embryos, one or more, appear first in the tentacula, from whence they can be withdrawn and transmitted to others by the parent, and are at last produced by the mouth. In the course of six years, a specimen preserved by the author produced above 276 young; some pale, and like mere specks, with only eight tentacula; others florid, and with twenty. They are frequently disgorged along with the half-digested food, thirty-eight appearing thus at a single litter. An embryo extracted artificially from the amputated tip of a tentaculum began to breed in fourteen months, and survived nearly five years. Monstrosities by excess are not uncommon among the young: one produced naturally, consisting of two perfect bodies, and their parts sustained by a single base, exhibited embryos in the tentacula at ten months, bred in twelve, and lived above five years. While one body was gorged with food, the other continued ravenous."†—These facts are to be explained on the supposition that the ova have been detained and developed in the interseptal spaces, or even in the stomach, for it is very well ascertained that the creatures are truly oviparous. The ovum, under ordinary circumstances, is recognizable as the young of an Actinia about twenty days from the time of its separation.‡ It has at first very few tentacula,—from four to twelve, arranged in a single row, but they gradually germinate in greater numbers, and arrange themselves in two or more imperfect circular series:§ a fact

* Phil. Trans. lvii. 429.

† Rep. Brit. Assoc. an. 1834, p. 599; and Edin. New Phil. Journ. xvii. p. 411.

‡ Dalyell in Edin. New Phil. Journ. xxi. p. 89, 90.—For an account of the structure of the ovum by Rathke, see *Burdach's* Traité de Physiologie, tom. iii. p. 65-67.

§ Dalyell in Edinburgh Encyclopædia, art. "Animal Flower," p. 132. Tem-

which strikingly illustrates the futility of that classification which mainly rests the distinction of its genera upon the number of these circles.*

The Actiniæ are very patient of injuries, and rival the Hydræ in their reproductive powers. They may be kept without food for upwards of a year; they may be immersed in water hot enough to blister their skin, or frozen in a mass of ice and again thawed; and they may be placed within the exhausted receiver of the air-pump, without being deprived of life, or disabled from resuming their usual functions when placed in a favourable situation. If the tentacula are clipped off they soon begin to bud anew, and if again cut away they grow again: so that "it seems these reproductions might extend as far, or be as often repeated, as patience or curiosity would admit." If cut transversely through the middle, the lower portion of the body will after a time produce new tentacula "pretty near as they were before the operation;" while the upper portion swallows food as if nothing had happened, permitting it indeed at first to come out at the opposite end, "just as a man's head, being cut off, would let out at the neck the bit taken in at the mouth," but which it soon learns to retain and digest in a proper manner. In an experiment of this kind, the upper half, instead of healing up into a new basis, actually produced another mouth and tentacula; so that an animal was formed which caught its prey, and fed at both ends at the same time! If again the section of the body is made in a perpendicular direction so as almost to divide it into two halves, these halves unite again in a few days. If the section is complete, two perfect individuals is the result; and to complete the wonder, if the body is torn away, and only a portion of the base remain, from this fragment a new offspring will sometimes rise up to occupy the place of its parent! † Yet these creatures, almost indestructible from mutilation and injury, may be killed in a few short minutes, by immersion in fresh water.

pleton in Mag. Nat. Hist. ix. 303; Harvey in ibid. n. s. i. p. 474; Rep. Ray Soc. 1845, p. 381.

* Brandt. A Synopsis of his System is given by Blainville. Actinologie, p. 666.

† Dicquemare in Phil. Trans. abridg. xii. 640, &c.; xiv. 129. Yet, according to the same excellent naturalist, a wound or rent of the *basis* of an Actinia often proves fatal. xiii. 637.

31. Anthea,* Johnston.

Character.—*Body cylindraceous, adhering by a broad base; tentacula disposed in circles round the mouth, elongated, tapered, and incapable of being retracted within the body.*

1. A. cereus, *body somewhat cylindrical, furrowed lengthways; tentacula numerous, longer than the body, smooth.* Gærtner.

Plate XLIV.

Urtica cinerea, *Rondel.* Poiss. 381.—Hydra tentaculis denudatis, numerossimis; corpore longitudinaliter sulcato, *Gærtner* in Phil. Trans. lii. 78, tab. 1, fig. 1. Phil. Trans. abridg. xi. 526.—Actinia Cereus, *Ellis* and *Soland.* Zooph. 2. *Turt.* Gmel. iv. 103. *Turt.* Brit. Faun. 131. *Rapp* Polyp. 56. tab. 2, fig. 3. *Grube* Actin. 11.—Act. sulcata, *Pen.* Brit. Zool. iv. 102. *Berk.* Syn. i. 186. *Stew.* Elem. i. 394. *Flem.* Brit. Anim. 498. *Lam.* Anim. s. Vert. iii. 69. Encyclop. Method. Vers, pl. 73, fig. 1, 2. *Bosc* Vers, ii. 257.—Hydra Cereus, *Stew.* Elem. ii. 451.—Anthea Cereus, *Johns.* Brit. Zooph. 221. *W. Thompson* in Ann. and Mag. Nat. Hist. vii. 481. *Hassall* in ibid. vii. 286. *Couch* Zooph. Corn. 34: Corn. Faun. iii. 81, pl. 14. fig. 2.

Hab. "Very frequent upon the sea-coasts" of Cornwall, *Gærtner.* Anglesea, *Pennant.* Torquay, *Dr. Coldstream.* Isle of Wight, common, *W. Thompson.* "The three varieties of this species, described by Gærtner, are found in Sandy Cove, near Dublin; the green one but sparingly. They usually adhere to Fuci, generally to *Fucus serratus,* and but rarely to stones. Below low-water mark." *A. H. Hassall.* "In September, 1835, I made a note of this species as being the most common *Actinia* at Ballyhome Bay, co. Down, where it was gregarious, forming in some places a continuous fringe round large rock-pools and stones, exposed to view at low water. In such quantity it is not now to be seen there, having become gradually scarcer since the period mentioned. In Dublin Bay and on the western coast this species likewise prevails. It is commonly of a dull ash-colour throughout, but wherever I have remarked it, some few indi-

* From ἄνθος—a flower: the name borrowed from Drayton—

> "*Anthea*, of the flowers, that hath the general charge,
> And Syrinx of the weeds, that grow upon the marge."

Since the name was published, I have learned that *Anthia* had been previously used for a genus of coleopterous insects, but the similarity between the words will scarcely justify a change in either. Risso's genus *Anemonia* appears to have been intended to embrace the same species as the Anthea, but if so, it is ill defined; and being formed merely by a misspelling of the old name *Anemone*, ought to be rejected from our nomenclature.

viduals were to be found of a green colour, with the tentacula partially or wholly red." *W. Thompson.*—"One day in July, 1840, when my friends R. Ball, E. Forbes, and G. C. Hyndman, were dredging in Clew Bay, on our western coast, they were highly attracted with the singular and beautiful appearance presented by vast numbers of this species, which, in one portion of the bay, were clinging to the narrow stems of an extensive sub-marine wood of Zostera marina; the position, too, being heightened by numerous spires of the Turritella terebra likewise rising from the Zostera, to which their animal inhabitants were adherent." *W. Thompson.*

"The body of this polype is of a light chesnut colour, and feels perfectly smooth, though it be lengthways sulcated by a number of sulci, that are frequently divided into three smaller ones, and are continued into the dentated margin that surrounds the upper periphery of the body, just beneath the insertion of the feelers. These feelers, arising from the disk of the polype, are, according to the age of the animal, between 120 and 200 in number: they exceed the body, when expanded, by more than an inch in length, and are of a beautiful sea-green colour, except towards their extremities, which are covered with a lively red, like that of the rose. The disk is of the same brown colour with the rest of the body, and contains in its centre the mouth of the animal, which is an aperture of various shape and diameter.—The two varieties of this species which I met with differ but little from the already described animal. The feelers of the one, instead of being green, are throughout of a red colour, like that of the mahogany wood. The other variety has pale ash-coloured feelers, marked with a small white line running along their back; its body is of the same chesnut colour with that of the first species; but the sulci are not divided, nor has it a dentated margin surrounding its upper periphery." *Gærtner.*

Mr. R. Q. Couch has given an excellent description of this species, which, he says, "appears to be a more active kind than any of the Actiniæ: its tentacula are constantly expanded, and in continued, though gentle motion. It moves freely about from place to place by a gliding motion of its base; or, by turning on its oral surface, can move far more rapidly by means of its tentacula."

Of his Actinia (Entacmaea) cereus, Ehrenberg says—"*Actiniam cereum* tentacula non retrahere posse fabulosum est." (Corall. 35.) Hence it is probable that his species is not identical with ours, for the testimony of Gærtner and Couch leaves no doubt on the fact of its inability to withdraw the tentacula within the body. In a

diseased or enfeebled state the animal exerts the power to do so to a partial extent :—" Although this species has not the power of shortening its feelers in the same way as the Actinias, yet, if specimens be kept for some time in sea-water, their length becomes diminished, not by contraction, but by a process of invagination."—*A. H. Hassall.*

2. A. Tuediæ, *body somewhat cylindrical, smooth or wrinkled with circular folds; tentacula numerous, shorter than the body, longitudinally striate.* G. J.

Actinia Tuediæ, *Johnston* in Mag. Nat. Hist. v. 163, fig. 58 ; and in Trans. Newc. Soc. ii. 246.—Anthea Tuediæ, *Johns.* Brit. Zooph. 221. *Landsborough* in Scot. Christ. Herald for April, 1840, p. 243.—Anemonia edulis, *Risso* l'Europ. mérid. v. 289.

Hab. Coast of Berwickshire, in deep water, rather rare, *G. J.* Cambray, on the west coast of Scotland, *Rev. D. Landsborough.*

Fig. 53.

Anthea Tuediæ is amongst the largest of our species. The body, when relaxed, generally measures three inches in length, and about the same in diameter. It is of a uniform reddish or brownish-orange colour, and either smooth or contracted at pleasure into circular folds. The base is smooth and orange-coloured, with a thin areolar skin. The mouth is ever varying in size and form, and there are often protruded from it vesicular-like lobes of a reddish

colour scored with fainter lines. When fully expanded, the oral disk is not less than four inches across : there is a smooth space between the mouth and tentacula, which are very numerous, and placed in several rows around the circumference ; those of the inner row are larger than the others, measuring frequently two inches in length, and they become gradually shorter in the exterior series. They are of a chesnut or reddish flesh-colour, often darker coloured towards the bases, but never variegated with rings of different hues, thick and clumsy, tapered to an obtuse point, marked longitudinally with distinct lines or impressed striæ, tubular, perforated at the ends, and constricted at their insertions. The creature has no power of withdrawing them within the oral aperture, nor does it seem capable even of shortening them in any considerable degree, but it twists them in a wreathed or spiral form, or gives the whole circle a greater or less degree of expansion.

The trivial name which I have bestowed on this species is intended to indicate the place of its first discovery, Tuedia being, according to Sir Robert Sibbald, the ancient name of the maritime parts of Berwickshire. It is not uncommon on that coast, but is found only in deep water, whence it is dragged up by the fishermen. I have often found the tentacula in a separated state adhering to their lines ; and as these retain their irritability and motion for a long time, they are apt to be mistaken for independent and perfect worms, which they much resemble.

32. Iluanthos,* Forbes.

Character.—"*Body cylindrical, tapering to a point at its posterior extremity, free? Tentacula simple, retractile, surrounding the mouth.*" E. Forbes.

1. I. scoticus. E. Forbes.†

Plate XLV. Fig. 1, 2.

Iluanthos scoticus, *Forbes* in Ann. Nat. Hist. v. 184, pl. 3. *W. Thompson* in Ann. Nat. Hist. xv. 322.

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* From ἰλὺς, mud, and ἄνθος, a flower. The Isacmæa crystallina, *Ehrenb.* Corall. p. 33, and the Is. Cleopatræ, Ibid. p. 34, seem to be species of this genus.

† Edward Forbes, Professor of Botany in King's College, London. In Chambers's Edinburgh Journ. Nov. 23, 1844, he is described as "a handsome, olive-complexioned youth, with long hair smoothed away to one side." Were he less eminent, or less my friend, his varied endowments and talents might have tempted me to a sketch of his character and writings.

Hab. Dredged up among Corbulæ and other inhabitants of mud, in four fathoms water, in Loch Ryan, on the west coast of Scotland, *E. Forbes.* "On the beach at Balbriggan (Ireland), after a storm, in March 1843," *Mrs. W. J. Hancock.*

"It is a free *Actinia,* about an inch and a half in length, the body large above, but tapering at its posterior extremity to a point. The mouth is round and rather small, surrounded by a circle of numerous long filiform tentacula, which are nearly equal in thickness throughout their lengths. The body is of a pink colour, with regular distant longitudinal white stripes: the tentacula are greenish, with a dark line down the middle of each: It is probable the animal fixes itself in mud by means of its attenuated extremity, which I regard as analogous to the terminations of *Virgularia* and *Pennatula.* In its anatomy it differs not from other *Actiniæ,* save that its ovaries converge." *E. Forbes.*

FAMILY—LUCERNARIADÆ.

This family has the same relationship to the other Helianthoida that Hydra has to the Hydroida. "Ovariorum dispositio *Medusis* affinior est quam *Actiniis.* In eundemque characterem ventriculi liberi penduliquc defectus abit." *Ehrenberg.*

33. Lucernaria,* Müller.

Character.—*Body somewhat campanulate, fixed when at rest by a narrow disk or stalk: mouth quadrangular, in the centre of an umbrellar expansion: tentacula disposed in tufts at regular distances on the peristomatous margin.*

1. L. fascicularis, "*peduncle of the body produced: tufts of tentacula in pairs, about a hundred in each.*" J. Fleming.

Plate XLV. Fig. 3—7.

Lucernaria fascicularis, *Fleming* in Wern. Mem. ii. 248, pl. 18, fig. 1, 2. *Flem.* Brit. Anim. 499. *Templeton* in Mag. Nat. Hist. ix. 304. *Lamouroux* in Mém. du Mus. ii. 470. *Ehrenb.* Corall. 43.

Hab. Common in Zetland, where "it is chiefly found on the leaves of Fucus digitatus and F. esculentus, which grow in deep water," *Fleming.* "Found on the coast at Donaghadee, after a strong easterly gale, adhering to a fragment of Fucus serratus," *Templeton.*

* From *lucerna,* a lamp.

Dredged by Mr. MacAndrew and myself in Hellswick vöe, west of Zetland, among Laminariæ in 4—7 fathoms. The locality is a sheltered creek, the water of which abounded in small Medusæ," *E. Forbes.*

"Colour dark-brown ; peduncle cylindrical, flexuous, wrinkled, with a narrow base ; body bell-shaped, subquadrangular, concave ; margin divided into four pairs of arms, concave within ; mouth central, tubular, consisting of a loose membrane, four notched at the tip, and also expanded, circular, or striated at the pleasure of the animal ; the inside with numerous white filaments."—"The animal contracts itself into various shapes. It moves the tentacula very quickly, especially if muddy water is poured upon it. Although I have kept it alive several days, I have never observed it in an upright position. It in general hangs downwards, as expressed in the figure ; sometimes, however, it is nearly horizontal." *Fleming.*—"When at rest it assumes very much the form of a common drinking-glass, and is exceedingly conspicuous from its beautiful rose tint." *Templeton.*

"The disk is quadrangular, with bifurcated angles, the extremity of each furcation bearing a tuft of 70 or more filiform, nearly equal tentacula, with swollen glandiferous tips. The bundles of tentacula, when expanded, bear a striking resemblance to the flowers of Thalictrum. The tentacula stand out in every direction. One of the angles of a specimen taken was trifurcated, and bore three tufts of tentacula, but this was a monstrosity, since the number of ovaries corresponding to this angle was only two, as at the others. The ovaries appear as translucent yellowish bodies shining through the purplish-brown disk. The tentacula are pale brown, with dark sienna-coloured tips. The back of the animal and peduncle are of a sienna-brown ; the foot or disk of adhesion is very small ; the mouth is four-lobed and pale. *Dimensions :*—Disk between the arms, $0\frac{7}{12}$: diagonal measurement from tuft to opposite tuft, $1\frac{1}{12}$: tentacle, $\frac{2}{12}$: body and peduncle when expanded, $0\frac{3}{4}$."

"In a jar of salt water it expanded, adhering to the sides by its fascicles of tentacula, and twisting about its peduncle, extending and contracting it like a trunk. In this way, and by turning over, it marched up the sides of the glass. When irritated in the dark it gave out brilliant flashes of bluish phosphorescent light, which seemed to me to proceed from the reproductive organs.

"When first brought up in a contracted state out of the water, it had much the appearance and feel of an Aplysia." *E. Forbes.*

2. L. AURICULA, *body campanulate; tufts of tentacula* 8, *equidistant, with a marginal tubercle between each pair.* Montagu.*

Fig. 54.

Holothuria lagenam referens tentaculis octonis fasciculatis, *Müll.* Zool. Dan. prod. 232, no. 2812.—Lucernaria auricula, *Fabric.* Faun. Grœnl. 341. *Montagu* in Lin. Trans. ix. 113, pl. 7, fig. 5. *Flem.* Brit. Anim. 499. *Johnston* in Mag. Nat. Hist. v. 44, fig. 29 ; and in Trans. Newc. Soc. ii. 248. *Templeton* in Mag. Nat. Hist. ix. 304. *Sars* Soëdyr. Naturh. 34, tab. 4, fig. 1-13. *Couch* Zooph. Cornw. 35 : Corn. Faun. iii. 83, pl. 16, fig. 1-3.—L. octoradiata, *Lam.* Anim. s. Vert. ii. 474.—L. auricule, *Lamour.* in Mém. du Mus. ii. 471.

Hab. Coast of Devonshire, *Montagu.* Adheres to Fuci, near low-water mark, on different parts of the coast, *Fleming.*

Our figures represent this beautiful animal in its natural size. The individuals from which they were drawn were of a clear pinkish red colour, but Montagu says that it is "pellucid, green, brown, purple, red, or yellow, and all the intermediate shades in different subjects." It adheres by a short stalk, cupped in its base and variable in its degree of distinctness, dilating into a sort of campaniform blossom, the margin of which is set round usually with eight short processes or arms, each of them terminated with a globose tuft of about sixty glanduliferous filaments (Fig. 55, *a*). The arms are

* George Montagu, Esq., F.L.S., the author of "Testacea Britannica," and of a much valued Ornithological Dictionary. His contributions to the history of invertebrate animals were also numerous, and always interesting: the best, perhaps, is his Essay on Sponges in the Wernerian Memoirs. He is often styled Colonel Montagu, having been for many years Lieutenant-Colonel of the Wilts Militia. He died at Knowle House, his residence, near Kingsbridge, Devonshire, on June 19, 1815, in the 76th year of his age (or rather, as stated in the Gentleman's Magazine, in his 64th year), from tetanus produced by a wound in his foot from a nail. (Annals of Philosophy, vi. p. 77.) His collections are now in the British Museum. For an estimate of his character see Fleming's Brit. Animals, Pref. p. x. ; and Forbes' British Star-fishes, p. 45-6 ; and for several interesting particulars, Mr. Yarrell's History of British Birds, i. p. 457.

Fig. 55.

mottled with two rows of spots, occasioned by the ova (*b*); and they are connected together by a thin transparent membrane. Between each pair there is an oval vesicle (*c*) placed on the edge of this membrane. Lamouroux asserts, apparently on the authority of Ch. Müller, that this vesicle appears only at certain seasons, and again disappears, a statement which requires confirmation. Mr. Peach believes them to be constantly present. The mouth forms a slight quadrangular projection in the centre of the cupped expansion, exactly opposite the contracted base.

In the specimens which furnished the vignette to this order (Fig. 57), there were nine glanduliferous tufts; and Montagu's figure represents a monstrosity with seven only, but as there is no appearance of marginal tubercles in it, the figure may belong to the following species. Mr. Cocks has found it pure white with five arms.

Otho Fabricius tells us—"Vescitur oniscis, præsertim *onisco abyssino,* quem semper fere solum in ventriculo ejus inveni; raro in majoribus squilla lobata occurrit. Hi miseri in aperturam corporis dilatatam offendentes, statim tentaculis concludentibus capiuntur et ingurgitantur.—Sæpe in uno verme plures oniscos invenire contigit, interioribus corruptis, exterioribus adhuc integris."

"Some time since I got four specimens of Lucernaria auricula, and I was much pleased to notice the use of the little marginal

tubercles between the bunches of tentacula : they are for the purpose of holding by, either for suspension or when removing from place to place. I repeatedly tried them. After first noticing it, I found that they could adhere firmly to a piece of sea-weed or a bent of hay ; and it was curious to see how quickly and firmly they held. I have not seen this fact noticed before." *C. W. Peach.*

3. L. CAMPANULATA, *body subsessile, campanulate ; tufts of tentacula eight, equidistant, without intermediate marginal tubercles.* Dr. John Coldstream.*

Fig. 56.

Lucernaria campanulata, *Lamouroux* in Mém. du Mus. ii. 472, pl. 16, fig. 1-7.—L. Convolvulus, *Johnston* in Mag. Nat. Hist. viii. 59, fig. 3.—Lucernaire auricule *Blainv.* Actinolog. pl. 50, fig. 4.

Hab. On sea-weed near low-water mark. Torbay, *Dr Coldstream.* Berwick Bay, *G. J.*

About an inch in height ; of a uniform liver-brown colour, smooth, adhering by a circular disk, above which there is a deep

* A native of Leith, where he is now settled as a physician. Dr. C. is an alumnus of the University of Edinburgh, and graduated M.D. in 1827 ; his Thesis being "de Indole Morborum periodica." He early distinguished himself by researches in Meteorology and Zoology, more particularly by his essays on the chromophorous globules of the Cephalopoda, and on Limnoria terebrans.

stricture or short peduncle : the disk even, strengthened by an interior cartilaginous lamina, which rises up the short peduncle, and forms a minute hollow firm centre. The margin of the oral expansion is somewhat thickened, and divided into eight equal arms, each furnished with a tuft of numerous short tentacula tipped with a gland, and brighter coloured than the body. The interior is hollowed like the blossom of a flower, the square extensible mouth projecting in the centre; and in the space between the arms there is a complicated structure composed apparently of two series of foliaceous processes arranged on each side of a white line that seems to spring from the sides of the mouth. These processes are formed by the complicated foldings of a thin membrane attached by one side in the manner of a mesentery : there are no vessels in the membrane, but some portions of it exhibit, when magnified, a kind of net-work of irregular cells, and the outer and free edge is bounded by a thread-like line. The white central line which divides them is formed of small roundish bodies arranged in two or three close series ; and some of these ova can at times be traced along the margin of the circumference to the tentacula. The latter are cylindrical and terminated with a globular head, which is seemingly imperforate. The stomach is a loose thin plaited extensible bag, having attached to its inner surface numerous filiform cæca (Fig. 56, *c*), that, after their removal from the body, retain their irritability for a long time, and writhe themselves like a knot of worms.

Dr. Coldstream has favoured me with the following observations on the habits of this Lucernaria :—“ I find the animal very hardy : it is constantly in a state of expansion, and does not contract excepting when very rudely handled. One specimen has lived with me for three weeks, although the water has not been very often changed. When I first procured it, the two rows of spots running from the mouth along each arm were prominent, and of a dark reddish-brown colour. Since that time they have increased in size, and have become studded with numerous white oval bodies which I suppose to be ova. I see some of these have made their way into the web connecting the arms, but I have not observed any expelled from the body.”—5th April, 1833.

Observations.

The Lucernariæ are of a gelatinous consistence. The skin or corium is smooth and thickish. After covering and giving form to the body it is reflected over the oral disk, and incloses, within the

duplicature formed by this reflection, the internal viscera. The body is more or less distinctly campanulate, and is prolonged inferiorly into a pedicle, very variable in length, which has its bottom conformed into a small sucker. From this point four ligaments, probably of a muscular nature, rise up within the peduncle, dividing at the expansion of the body into eight distinct fasciculi, one proceeding to each arm. These fasciculi are composed of long parallel fibres, are analogous to the lamellæ of the Actiniæ, and like them divide the body into eight equal compartments, for the inner fold of the corium is intimately connected with them on both sides. The vermiform cæca lie in these compartments; and the ova appear also to be generated in them, but whether they have an appropriate ovary is doubtful. A specimen which had undergone a certain degree of putrefaction and dissolution exhibited these ova forming a complete circle round the mouth, with rows running up the arms to the base of the tentacula. (Fig. 55.) The ova were proportionably large, roundish or oval (Fig. 55, *d*), and irregularly grouped. The change produced in the appearance of the tentacula was considerable, for the globular apex had disappeared, and all had assumed a linear or conical figure (Fig. 55, *e*),—the centre filled with an opake granular matter forming a dark speck at the apex, and covered with a clear mucous skin. The vesicle presented precisely the same structure, but no aperture was visible in either part.

The Lucernariæ can swim with some rapidity in the water by alternate dilatations and contractions of the body, but they are usually found adherent to sea-weeds, the first species in a dependent position, the two latter invariably erect, so that Lamarck is in error when he describes the mouth as being inferior. When in a state of expansion, few marine worms exceed them in beauty and singularity of form; when contracted they are shapeless and easily overlooked. They feed on small crustaceous animals brought within reach by the tide or their own destiny,* and to arrest them

* Lamouroux asserts that L. campanulata perceives its prey when within a short distance and pursues it. His words are—"J'avois la précaution de changer l'eau de mes Lucernaires deux fois par jour. Dans un vase qui ne contenoit qu'un de ces animaux, ce dernier exécuta des mouvements qui me parurent extraordinaires dans un être d'un consistance aussi molle, immédiatement après que j'y eus de l'eau nouvelle: avec la loupe je m'aperçus que ces mouvemens étoient causés par la présence d'un animalcule que la Lucernaire sembloit pursuivre en se portant à droite et à gauche, pour tacher de le saisir. Toutes les fois qu'il s'éloignoit à la distance d'environ un pouce, la Lucernaire cessoit tout mouvement; s'il se rapprochoit, la chasse

more certainly the tentacula are widely displayed; but no sooner have they felt the prey than they instantly contract, envelope it in their joint embrace, and carry it to the mouth by an involution of the whole marginal circumference. I have found that the glands with which the tentacula are tipped perform the office of suckers, as Lamarck conjectured, and thus retain their captives with greater certainty: but if Dr. Fleming's figure of L. fascicularis is correct, its tentacula are not glanduliferous.

"Their mode of progression differs under different circumstances. If intending to move to any great distance, they do so by loosening their attachments, and then, by various and active contortions, they waft themselves away till they meet with any obstruction where they rest; and if the situation suits them, they fix themselves,—if not, they move on in the same manner to some other spot. If the change be only for a short distance, as from one part of the leaf to another, they bend their campanulate rims, and bring the tentacula in contact with the Fucus, and by them adhere to it. The footstalk is then loosened, and thrown forward, and twirled about, till it meets with a place to suit it; it is then fixed and the tentacula are loosened, and in this way they move from one spot to another. Sometimes they move like the Actiniæ, by a gliding motion of the stalk.

"In taking their prey they remain fixed with their tentacula expanded, and if any minute substance comes in contact with any of the tufts, that tuft contracts, and is turned to the mouth, while the others remain expanded watching for prey." *R. Q. Couch.*

recommençoit de suite, et les mouvemens étoient vifs et prompts. L'animalcule fut enfin saisi par les tentacules d'un des rayons, qui à l'instant se replie vers la bouche; les autres restèrent toujours étalés: ce rayon reprit peu à peu sa position ordinaire. M'étant procuré d'autres animalcules, je les donnai à mes Lucernaires, et j'eus le plaisir de voir leurs mouvemens se répéter avec les mêmes circonstances." Mém. du Mus. ii. 464.

NOTES.

1. Pocillopora interstincta, p. 194. Of this coral the Rev. Dr. Fleming exhibited "a characteristic drawing, by the late Mrs. Hibbert," to the Royal Society of Edinburgh, on the 2nd March, 1846. The drawing was made from a Zetland specimen. Edin. New Phil. Journ., July, 1846, p. 203.

2. Oculina prolifera, p. 195. Additional evidence of this being a British coral has been procured. At a meeting of the Royal Society of Edinburgh, the 2nd March, 1846, the Rev. Dr. Fleming "exhibited a specimen, six pounds in weight, of

the *Madrepora prolifera* of Müller, which was found last summer by fishermen, their lines having become entangled with it in tho sea between the islands of Rum and Egg." Edin. New Phil. Journ. July, 1846, p. 203.—I am also informed by my friend Mr. Alder, that there is a fine large specimen of *Oculina prolifera* in the Newcastle Museum. It was procured from Shetland, some years ago, by Mr. Geo. C. Atkinson, who presented it to the Newcastle Natural History Society. The specimen is, says Mr. Alder, eight or ten inches across.

3. Mr. W. Thompson has sent me a living specimen and description of a new species of *Corynactis;* and a full account of a new genus of helianthoid zoophyte, of which the *Dysidea papillosa* of my "British Sponges," p. 251, is the dried case or skin. I must defer the description of these interesting novelties to an Appendix, to have time to procure engravings of the figures.

4. Lucernaria quadricornis, corpore elongato tortili, brachiis quatuor dichotomis, apice tentaculatis. *Müll.* Zool. Dan. prod. 227. Zool. Dan. i. 51. tab. xxxix.—Since this sheet was in proof I have received a communication from Mr. Joshua Alder, in which he tells me that he found this Lucernaria adhering to stones at low-water mark at Ardrossan, in May, 1846. The number of tentacula in each tuft appeared to be from ten to fifteen, and certainly do not much exceed this number in the specimen Mr Alder has sent me.

Are *L. quadricornis* and *L. fascicularis*, p. 244, distinct species? The main distinction is made to rest upon the number of tentacula in each fasciculus; and the character seems to be quite insufficient. In Mr. Alder's specimens the number does not exceed twenty; Müller says that they vary from thirty to forty; Mr. Forbes found them to be seventy or more in what he considered to be L. fascicularis; and Dr. Fleming says that in this "the tentacula are upwards of a hundred in number."—I am inclined to conclude that L. fascicularis ought to be reduced to a synonym of L. quadricornis.

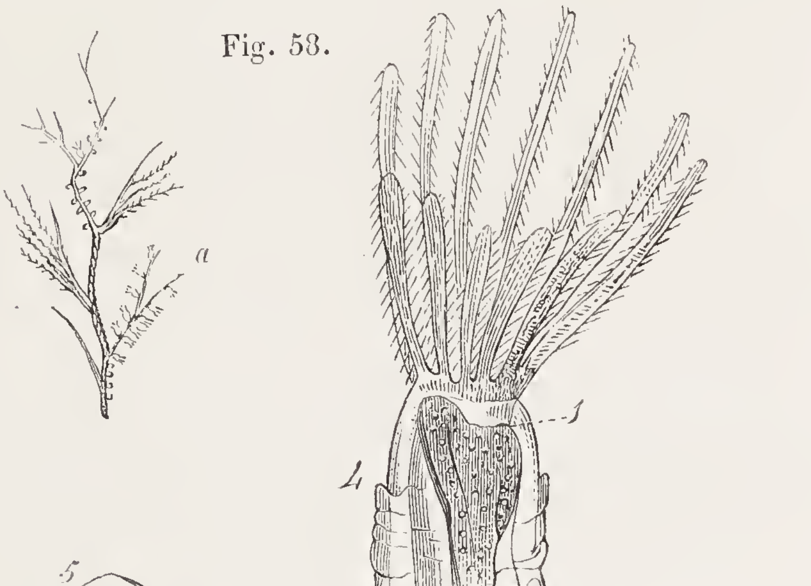
Fig. 57.

CLASS

POLYZOA.—J. V. THOMPSON.

POLYZOA, *J. V. Thompson* Zool. Research. Mem. v. 92. *J. E. Gray* in Syn. Brit. Mus. 133.—BRYOZOA, *Ehrenberg* Corall. des Roth. Meeres 153. *Jones* Anim. Kingd. 107-117. *Owen* Lect. 93-101.—MOLLUSCAN ZOOPHYTES s. ZOOPHYTA ASCIDIOIDA, *Johnston* in Mag. Zool. and Bot. i. 448.—Les BRYOZOAIRES, *Audouin* and *Milne-Edwards* in Lam. Anim. s. Vert. ii. 104, 2de edit.—CILIOBRACHIATA, *Farre* in Phil. Trans. an. 1837.—POLYPES TUNICIENS, *M. Edwards* Mem. 16.

Fig. 58.



LAGENELLA REPENS.

"How many animals, whose middle part
The sharpest eye
Can't see!
How subtle then the guts, the heart, the eye!
How thin each little member of the whole!"

LUCRETIUS, s. *Creech.*

The Polyzoa are divisible into two Orders:

I.—Infundibulata. Natives of the sea. Polypes compound, the mouth surrounded with ciliated filiform retractile tentacula, which form an uninterrupted circle: ova ciliated.

II.—Hyppocrepia. Lacustrine or natives of fresh water. Polypes compound, the mouth surrounded with ciliated retractile tentacula, interrupted or depressed on one side, so as to assume a crescentic or horse-shoe form: ova unciliated.

⁂ The name which this class should bear is still disputed. Bryozoa, conferred on it in 1834 by Ehrenberg (see Agassiz's Nomenclator Zoologicus), is the one in common use. Mr. Thompson says that he discovered the class in 1820, but his memoir has no date. It was not published previous to 1832, nor later than 1834; and my belief is that it was published in 1833: hence the adoption of his name—Polyzoa. Agassiz is wrong, both in assigning the invention of this name to Gray, and in his date of its introduction to science.

POLYZOA INFUNDIBULATA.

Polypiaria infundibulata, *P. Gervais* in Ann. des Sc. Nat. vii. (1837) 79.

In the preceding class we found reason to conclude that the polypidom of the Hydroida was a sheath disconnected, or at least not in organic union, with the soft pulpous matter which it invests and protects; that the corresponding part in the Asteroida, become an interior skeleton or axis, held the same relation to its polypiferous crust; nor was this relation altered when the polypidom had again, in the Helianthoida, assumed an external position, forming an integral part of the epidermis. In all these instances the polypidom appears to be unorganized, and when once formed, beyond the reach of change from either the polypes or its own inherent powers; * but in the present class, the cell, although pre-eminently entitled to the name of polypidom from its appearance and use, is a living portion of the animal which it seemingly contains. The cell is in fact the outer tunic of the polype, analogous to the envelope of the compound mollusca, endowed certainly with no very sensible or active properties of life, yet in organic connexion with the interior parts, and liable to organic changes. The relationship in which they stand to one another is nearly, if not precisely, the same as that which the fleshy crust of the Asteroida bears to its polypes, as a comparison of the Alcyonium with the Alcyonidium or Alcyonella will render sufficiently plain; and it is not less real even in those genera where the cells, when dried, have hard calcareous, and apparently impermeable parietes. For the proof of this fact,—a very important one in their physiology, and in any question touching their rank in the animal kingdom,—naturalists are principally indebted to Milne-Edwards.† The

* "Unorganized non-vascular parts are produced by an organized matrix, and grow by the continued deposition of new matter *on one surface*."—Müller's Elements of Physiology, p. 384.

† Ann. des Sc. Nat. vi. p. 25-31. A translation of Milne-Edwards's remarks is given in the first edition of this work, p. 327, &c. See also Couch's Corn. Faun. iii. p. 91.

connexion is effected by means of an inner tunic, which, after inclosing the polype's body as in a pouch, is afterwards reflected over the aperture of the cell,—the reflected portion becoming exterior and solidified either by calcareous depositions in its texture, or by a mutation of its thin membranous character into a horny investment better suited to the office it has now to perform of protecting the sentient body from a too rough contact of the medium in which the animals live, and from worse foes. From this mode of connexion it results that when the polypes retire within, they at the same time must close the aperture to their cells, for that portion of the inner tunic which is pushed outwards by their exit, in their withdrawal follows the body by a process of invagination, becoming at one and the same time a sheath for the column of tentacula, and a plug to the aperture, which, when of a flexible material, has its margin also drawn tighter and closer together.

The polype which endues itself with this cell is widely different from any we have yet described. Between the polypidoms, however, there is often an apparent affinity. The Crisiadæ are not unlike the Sertulariadæ, and it is still disputed whether some Gemmicellariæ appertain to this family or to the Flustræ: the resemblance between the Sertulariæ and the Vesiculariadæ misled even Lamarck to their union under one genus; and their names would seem to imply that the framers of the genera Alcyonidium and Alcyonella believed them to be in a family relationship to Alcyonium. These are examples which prove the fallacy of outward characters; and how darkly the naturalist must grope his way who would walk through Nature's labyrinth without the Ariadnæan thread that the anatomist alone can give him! In the instance before us he has demonstrated that the resemblances indicated above imply no propinquity in their objects. The Polyzoa or ascidian polypes the Creator has cast in the mould not of the Radiata, but of the Mollusca, yet with such a considerable variation as to mark their ordinal distinctness; for the Mollusca tunicata, their nearest allies, are not protrusive from their cells as these polypes are; and this seeming slight discrepancy connects itself, perhaps of necessity, with a total change in the position and

nature of their respiratory organs. Interior and immotive in the one tribe, they line, in a reticular pattern, the parietes of a sac capacious enough to contain a sufficiency of the aërating fluid; while in the other they clothe the exsertile tentacula in the form of cilia which must be placed outwards amid the circumfluent waters before they can play and fulfil their functions.

The Polyzoa never occur in a separate and naked form, but are always placed within the cells of a polypidom of a calcareous, membranous, or fibro-gelatinous consistence; and of so many dissimilar figures as to render a general description of it impossible. The form of the cells in many genera, as in Eschara, Flustra, and Cellepora, suggests a belief that their tenants, although arranged in a close and determinate manner, are each separate from their neighbours and complete in themselves,—an opinion that was held by some of our best naturalists; but the observations of Dujardin on some allied fossil polypidoms, render it very probable that there are pores of communication between the cells; * while those made by Professor Grant seem to have proved that the polypes of the Flustra are connected together by a living axis, and are hence truly compound beings. Since the Vesiculiferæ also, which are admitted to be composites, belong unquestionably to this remarkable form of animated entities, it is safer, for the present, to consider all the Polyzoa as compound polypes.† There is, nevertheless, a remarkable difference between them and the Anthozoa in their mode of composition. In the latter the polypes are simply developments of the common central fleshy mass, identical with it in structure and texture; in the former each indi-

* Blainville's Actinologie, p. 675. See Ann. des Sc. Nat. vi. p. 320.

† "The polypi are most intimately and inseparably connected with the *axis* by three parts of their body, and are only digestive sacs or mouths developed by the axis, as in all other zoophytes, for the nourishment of the general mass. By the *axis* of a zoophyte, I understand every part of the body excepting the polypi, whether of a calcareous, horny, or fleshy nature. The exact mathematical arrangement and forms of the cells of Flustræ is incompatible with their existence as separate and independent beings, but is quite analogous to what we are accustomed to observe in Cellariæ, Sertulariæ, Plumulariæ, and many other well-known compound animals."—Grant in Edin. New. Phil. Journ. iii. 116. See also Blainville, Man. d'Actinologie, p. 99.

vidual is a distinct organism, and the medium which binds them together, whether vascular or ligamentous, has its own peculiar character. The one we may compare to a chain of which all the links are welded,—the other to a necklace where the beads are strung together by a percurrent thread.

The body of the Polyzoa is lengthened, somewhat cylindrical, or at times bulged at the base, and when at rest lies, in the form of a syphon, doubled up upon itself in the cell, (Fig. 59,) to which it is connected by a tendon at the bottom, and by the duplicature of a thin membrane round the aperture, so that it is impossible it should ever voluntarily leave the cell to swim at large, as Baster and others have maintained. The head or upper end is surrounded by a single row of tentacula, (Fig. 60, *a*), which are tubular, filiform and non-contractile, for the animal can only shorten them, excepting to a slight extent, by rolling them up in a spiral manner. They are apparently smooth, but with a high magnifier it is ascertained that they are clothed with numerous fine cilia,* which are in ceaseless motion, and are supposed to perform the office of breathing organs by keeping up a constant current of water along their surfaces. The current sets in towards the mouth in an invariable direction; and from the incessant revolution of particles within the mouth and the gullet, observed by Professor Grant, this organ seems to be also ciliated internally. The more especial use of the tentacula is to arrest the prey which chance floats within their reach and conduct it to the mouth,—a simple aperture placed in the centre of the tentacular circle, and

Fig. 59.

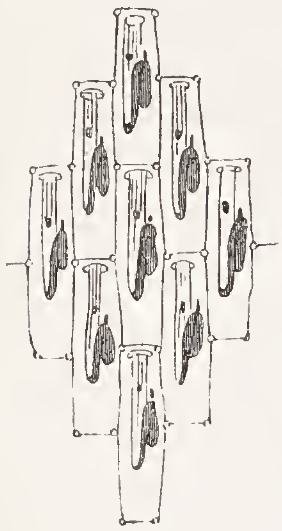
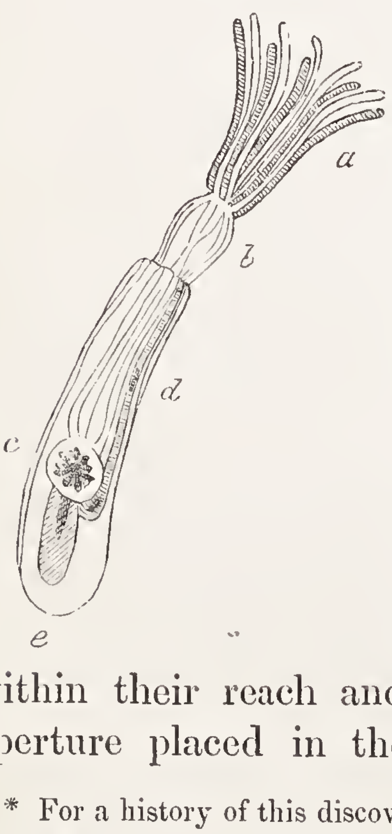


Fig. 60.



* For a history of this discovery, written with great learning and impartiality, see Dr. Sharpey's article "Cilia," in the Cyclopædia of Anatomy and Physiology, vol. i. p. 609.

which is armless, having in no instance either jaws or teeth. It is the entrance into a long membranous gullet (*b*), of perfect transparency, and which can be traced through its equally transparent envelope, to its termination in a somewhat globular and comparatively large organ placed near the curvature of the body, and rendered opaque partly by the greater thickness and fleshiness of its structure, but perhaps more so by the nature of its contents. This is the stomach (*c*), and from the side of it there proceeds a narrow intestine (*d*), which follows a straight upward course along the side of the gullet, and opens at the aperture of the cell by a separate orifice, from which the undigested remains of the food are ejected. There is another organ of a roundish figure appended to the bend of the intestine, which is supposed by some to be an ovarium (*e*),* but it seems not unnecessary to remark, that this appropriation of it to the generative function has perhaps no better proof than what is derived from a similarity of position between it and the supposed ovarium of the compound mollusca. It is, I presume, the organ which Blainville says he is willing to believe performs the functions of the liver.†

No trace of a nervous‡ or vascular system of any kind has been detected, nor is there any organ of sense, but the polypes are notwithstanding very sensible of external impressions. When left undisturbed in a glass of fresh sea-water, they push their tentacula beyond the mouth of the cell by straightening the body; and then expanding them in the form of a

* Thompson, Zool. Researches, p. 96.

† Manuel d'Actinologie, p. 72.—According to Van Beneden, there is no trace of liver in these polypes. Rech. sur les Laguncula, &c. p. 8.

‡ "No trace of either nerves or ganglia could be detected; yet the attributes of a nervous system were so clearly exhibited as to leave no doubt but that this must exist, and probably in some degree of perfection. Not only was the delicacy of their sense of touch very strongly marked, but the operations also consequent upon the enjoyment of such a sense were sometimes singularly striking. This is seen in the instant retiring of the animal on the slightest alarm, and the caution which it sometimes shows before emerging again from its cell; in the obvious selection of its food; and in the pertinacity with which it refuses to expose itself to water that has become in the least degree deteriorated." *Farre* in Phil. Trans. an. 1837, p. 414.—Traces of a supra-œsophageal ganglion and nerves, similar to the more defined system of the Mollusca tunicata, have been since observed by Van Beneden. Rech. Les Laguncula, p. 11.

funnel or bell, they will often remain quiet and apparently immoveable for a long time, presenting a very pretty and most interesting object to an observer of "the minims of nature." If, however, the water is agitated they withdraw on the instant, probably by the aid of the posterior ligament or muscle;—the hinder part of the body is pushed aside up the cell, the whole is sunk deeper, and by this means the tentacula, gathered into a close column, are brought within the cell, the aperture of which is shut by the same series of actions. The polypes of the same polypidom often protrude their thousand heads at the same time, or in quick but irregular succession, and retire simultaneously, or nearly so, but at other times I have often witnessed a few only to venture on the display of their glories, the rest remaining concealed; and if, when many are expanded, one is singled out and touched with a sharp instrument, it alone feels the injury and retires, without any others being conscious of the danger, or of the hurt inflicted on their mate.

The polypidom, formed in some species of a congeries of many thousand cells, begins with one only. This original or seminal cell has no sooner been completed, or even in many instances previous to its perfection, than another begins to shoot out from a fixed point of its parietes, the bud gradually enlarging and developing itself until the form and size of the primary one has been attained. This process can most easily be traced in the Vesiculariadæ, and in our common Flustræ and Escharinæ, where round the margin of the crust cells can at all seasons be observed in every stage of their evolution;—one just jutting out, another half-formed, and others again nearly complete. They never originate in the body of the polype, but always from the parietes, or rather the connecting medium; nor indeed is the embryo distinguishable within until the cells have made considerable advances to maturity. Then the softer parts begin to assume a shape, and gradually to limb themselves after the similitude of their antecedent copartners, when, having reached their term and ready for a partial independency, they burst their outward cerements,—always at a fixed point prepared for their exit by the same Power which has moulded the whole.

From this mode of increase there would seem to be no

natural limits set to the magnitude and duration of the polypidom, except what arise from accident or extrinsic causes. The original polype and its immediate successors may grow old, languish, and die; but the solid cells remain in their connection as a root and fixture, while the newer races, which have sprung up towards the outskirts, continue their work,—generation following generation in rapid and ever-multiplying successions. The polypidom in this respect resembles a tree in its growth: the trunk and main branches have stood years and centuries, but the increase has been made by annual shoots and renewals, and the last know only vigour and power of renewal. And as the form of the tree depends on the fashion of its ramifications, so that of the polypidom on the mode of evolution of its cells, for every part of the axis is not equally organised to produce buds, nor the same parts in all. Hence if the primitive cell has only one point fitted for this gemmation, the polypidom will be builded up in a catenated chain; if the cell has two points, two series of cells are formed; and so on with more. In several species the multiplication goes on in a regular arithmetical progression, but in others the cells are heaped together without apparent regularity, as in the Alcyonidiæ, where the softness of all the parts seems to allow of a non-regulated succession of buds. The general disposition of the cells, however, in this order, is certainly after the quincunx, affording examples which the learned Sir Thomas Browne would have gladly adduced in proof that "Nature geometrizeth and observeth order in all things, and of the generality of this mystic figure." Nor indeed were they entirely overlooked by this observant physician: "The spongy leaves of some sea-wracks," he says, "Fucus, Oaks, in their several kinds, found about the shoar, with ejectments of the Sea, are over-wrought with net-work elegantly containing this order (the quincunx): which plainly declareth the naturality of this texture; and how the Needle of Nature delighteth to work, even in low and doubtful vegetations."*

So many of the Polyzoa have been ascertained to be hermaphroditical, that it is fair to conclude they all are so.†

* The Garden of Cyrus, p. 33. Lond. 1686. folio.

† Van Beneden sur le genre Laguncule, p. 16.

The ova, as Professor Grant discovered, proceed from no peculiar organ in the body of the polype, but from the "common connecting medium," and only differ in their origin from the gemmules in pullulating from its inner surface;* and a wider survey of the class has fully confirmed this discovery. Germinating in every species from the inner surface of that portion of the skin or coat which lines the interior of the cell, the ovum falls, when mature, into the space between it and the body of the polype; and in this cavity, which is always full of a fluid, probably sea-water, it grows and appears to be rendered fruitful by admixture with the spermatozoa that are there prepared for this union. In many genera ova are produced also in thin calcareous capsules, which lie over and above the apertures of the polype cells; but even in them the matrix is the lining membrane, and this is identical with that of the cell itself. Wherever produced the ova are globular or ovate, or have a tendency to these shapes, and the surface is clothed with vibratile cilia; yet not universally, for ova without cilia have been detected both in the cells and capsules, and they have been seen apparently ready to escape outwardly in this naked condition,† although it is conjectured that cilia are subsequently developed. It is by means of these microscopic organs that they are moved to and fro,—first within the sac of the parent cells, and then after birth throughout "this great and wide sea," so to fulfil their mission in creation, and people the shores of every clime with myriads of busy workers in horn and in lime, which, with subtile chemistry, they draw from a fluid quarry, and build up in textures of admirable beauty and heaven-ordered designs. "O how desirable are all His works! and that a man may see even to a spark. All these things live and remain for ever for all uses, and they are all obedient. All things are double one against another: and He hath made nothing imperfect. One thing establisheth the good of another: and who shall be filled with beholding His glory."—*Ecclesiasticus.*

* Edin. New Phil. Journ. iii. p. 116-17.

† Reid in Ann. and Mag. Nat. Hist. xvi. p. 399.—Several of the ciliated infusorial animalcules described by Müller and others appear to be merely the ova of polyzoan polypes.

SYNOPSIS OF THE FAMILIES AND GENERA.

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* Polypidoms calcareous; the cells tubular with a round terminal aperture uncovered with an operculum. TUBULIPORINA.

Family TUBULIPORIDÆ. *Polypidoms multiform, massive or crustaceous.*

TUBULIPORA. Polypidom wart-like with a defined base, the cells suberect, aggregated or imperfectly rowed.

DIASTOPORA. Polypidom crustaceous, undefined, the cells horizontal, semialternate.

PUSTULIPORA. Polypidom erect, branched, the cells opening all round, semialternate or irregular.

IDMONEA. Polypidom dichotomous, the segments free, the cells in alternating cross-rows on one surface.

ALECTO. Polypidom creeping, adherent and ramous, the cells in one or more series.

Family CRISIADÆ. *Polypidoms confervoid, jointed.*

CRISIADA. Polype-cells uniserial.

CRISIA. Polype-cells biserial

* * Polypidoms calcareous or membrano-calcareous, multiform, composed of oblong or oviform cells, whose subterminal aperture is closed by a membranous fold or operculum. CELLEPORINA.

Family EUCRATIADÆ. *Polypidoms branched in a confervoid manner; cells oblong; no ovarian capsules.*

† The Polypidoms erect.

EUCRATEA. Cells produced in a single linear series.

GEMELLARIA. Cells geminate.

† † The polypidoms creeping, adnate.

HIPPOTHOA. Cells linked, anastomosing.

ANGUINARIA. Cells scattered, erect.

Family CELLEPORIDÆ. *Polypidoms massive or crustaceous, composed of ovate cells in juxta-position, the aperture terminal, often furnished with a globular capsule.*

CELLEPORA. Polypidom lobed or ramous; cells heaped.

LEPRALIA. Polypidom crustaceous; cells in a single layer.

MEMBRANIPORA. Polypidom crustaceous; cells quincuncial.

Family ESCHARIDÆ. *Polypidoms multiform, composed of oblong sub-quadrangular cells, disposed in semi-alternating series; the cells conjunct, horizontal to the plane of axis, with a sub-terminal or lateral aperture, usually covered with an ovarian capsule.*

CELLULARIA. Polypidoms dichotomously divided, the segments narrow, composed of one, two, or three rows of oblong cells, whose apertures open on the same plane.

FLUSTRA. Polypidoms foliaceous or membranous, composed of several series of oblong-quadrangular cells on two planes, or one only.

ESCHARA. Polypidoms membrano-calcareous, frondescent, the cells immersed, in a double layer placed back to back, like the cells in honey-comb.

RETEPORA. Polypidom calcareous, frondescent, netted; the cells on the upper side only.

SALICORNARIA. Polypidom dichotomous, with jointed cylindrical branches; cells immersed, rhomboidal.

* * * Polypidoms sponge-like, fleshy, polymorphous; the cells irregular in disposition, immersed, with a contractile aperture: no external ovarian capsules. HALCYONELLEA, *Ehrenb.* Corall. 153.

ALCYONIDIUM. Polypidoms fleshy, lobed, erect.

CYCLOUM. Polypidom encrusting; the ova in circular clusters.

SARCOCHITUM. Polypidom encrusting; the ova scattered singly throughout.

* * * * Polypidoms confervoid, horny, fistular; the polype-cells free. VESICULARINA.

Family VESICULARIADÆ. *Body of the polype separate from the parietes of the cell, which is deciduous.*

SERIALARIA. Polype-cells uniserial coalescent.

VESICULARIA. Polype-cells uniserial, disjunct.

BEANIA. Polype-cells scattered, solitary.

VALKERIA. Polype-cells clustered, irregular, the Polypes with eight tentacula.

BOWERBANKIA. Polype-cells clustered, irregular, the Polypes with ten tentacula.

FARRELLA. Polype-cells clustered, irregular, the Polypes with twelve tentacula.

Family PEDICELLINÆ. *Body of the polype adnate to the cell.*

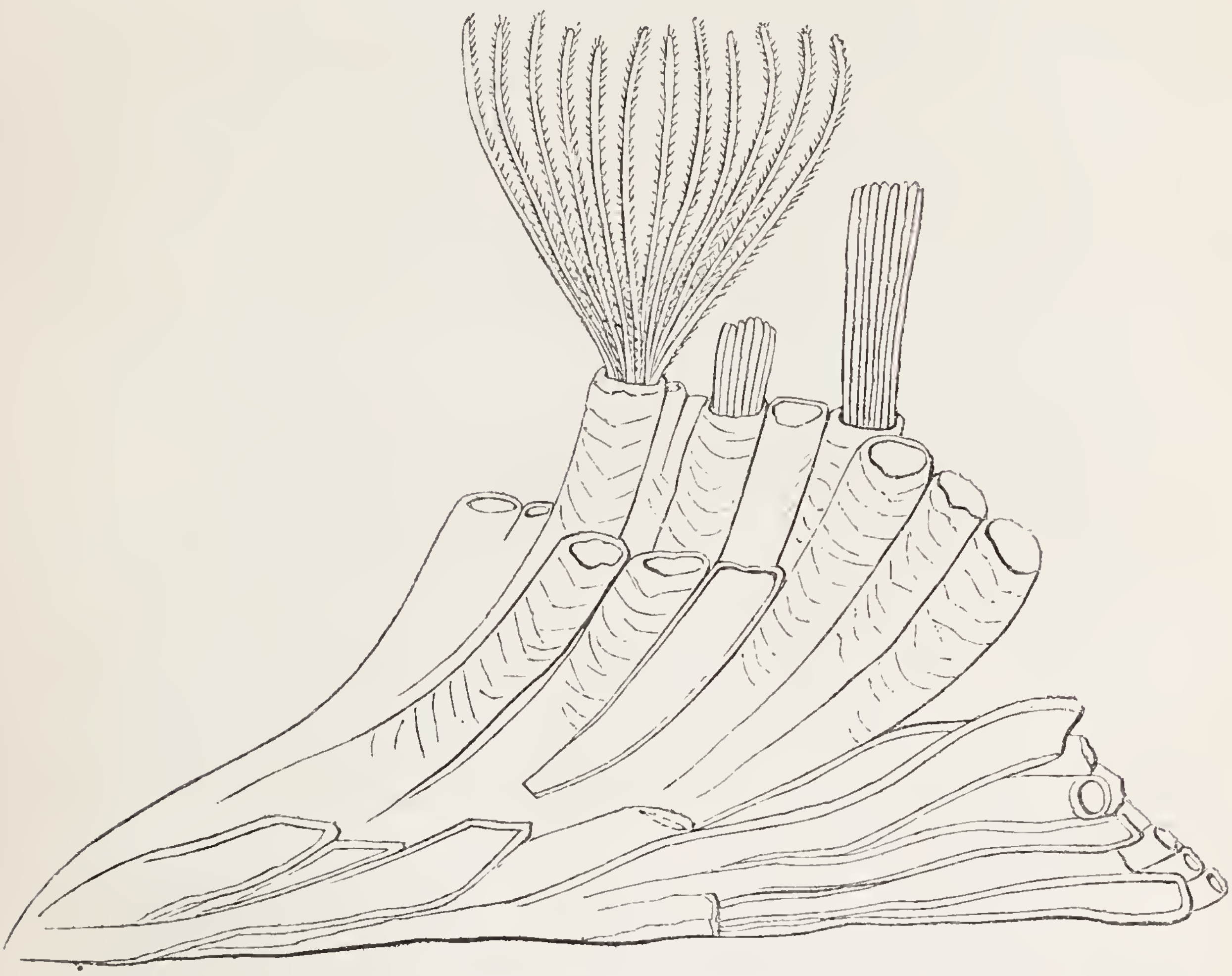
PEDICELLINA. The only genus.

POLYZOA INFUNDIBULATA.

I.—TUBULIPORINA.

Les TUBULIPORIENS, *Milne-Edwards* Mem. sur les Crisies, p. 14.—TUBULIPORIDÆ, *Johnston* in Trans. Berw. Nat. Cl. 107. — AULOPORINA, *Ehrenberg* Corall. des roth. meer. 153.

Fig. 61.



FAMILY—TUBULIPORIDÆ.

TUBIPORADÆ, *Flem.* Brit. Anim. 528.—TUBULIPORIDÆ, *Johnston* Brit. Zooph. 247. —Les TUBULIPORES, Milne-Edwards in Ann. des Sc. Nat. viii. 321.—TUBULIPORIDA, *J. E. Gray*, in Syn. Brit. Mus. 135.

CHARACTER.—*Polypidoms calcareous, massive, orbiculated or lobed or divided dichotomously; the cells long and tubular, with a round prominent unconstricted aperture.*

The animal of the Tubuliporidæ was first described by Milne-Edwards. It is an ascidian polype of the simplest kind, and the tenant of a calcareous elongated and tubular cell which has a round aperture unprotected by any valvular apparatus or operculum. At

their base the cells are a little narrowed and inclined to be horizontal, but the upper portion is more or less raised, and, in some species, becomes quite erect: they are arranged normally in rows which radiate from a centre, but this disposition is often interfered with, when the cells become confluent, as they often do in the progress of development.

The polypidoms are always small, neat, and pretty. They are found on submarine bodies affixed by a thin calcareous basis, the form of which varies in different genera; and the cells are produced from its free or upper surface. These are developed in regulated succession by buds proceeding from the base of the primary ones, and the bud must apparently always be projected from the exterior side of the parent cell, for otherwise it would not be easy to explain the fact of their never covering up the central cells, and of their being set in rows or series which diverge from a centre or a medial line. The form of the polypidom is liable to be influenced by the nature of the site on which it is developed, and this has given rise to some difficulty in the determination of the species. They have probably been over multiplied, but this seems unavoidable in the present state of our knowledge of them.

The ova are unknown. The polype never produces an external ovarian capsule.

1. Tubulipora,* Lamarck.

Character.—*Polypidom depressed, circular or lobed, adherent by a thin calcareous basis: cells clustered, inclined to be rowed, erect or subhorizontal, more or less free at the round terminal aperture.*

* With a thin sessile cupped basis. (Discopora, *Fleming.*)

1. T. patina, *base sessile, circular and cupped, with a thin scored margin; the tubular cells crowded towards the circumference and rowed, with a plain circular aperture.* Pallas.

Plate XLVII. Fig. 1, 2, 3.

Caryophyllus sive Fungites minimus tubulosus littoris Ariminensis, *Planc.* de Conch. min. not. 26. tab. 2, no. 9.—Madrepora verrucaria, *Lin.* Syst. edit. x, 793. *Lin.* Syst. 1272. *Pall.* Zooph. var. β. 281. *Turt.* Gmel. iv, 616. *Oliv.* Zool. Adriat. 218. *Esper* Madrep. tab. 17, fig. a. A. (not good.) *Turt.* Brit. Faun. 204. *Stew.* Elem. ii, 426. *Hogg's* Stock. 38.—Millepora verrucaria, *Ellis* and *Soland.* Zooph. 137.—Tubulipora patina, *Lam.* Anim. s. Vert. ii, 163: 2de edit. ii, 244. *Risso* l'Europ. Merid. v, 338. *Blainv.* Actinolog. 425. *Johnston* in Trans.

* From *tubulus*, a tube; and πορος a passage.

Newc. Soc. ii, 269, pl. 9, fig. 8. *Milne-Edwards* in Ann. des Sc. Nat. viii, 329, pl. 13, fig. 1. *Thompson* in Ann. Nat. Hist. v. 252. *Hassall* in ibid. vi. 170. *Couch* Zooph. Cornw. 44 : Corn. Faun. 103.—Discopora verrucaria, *Flem.* Brit. Anim. 530.

Var. β. Tubulipora bellis, *Thompson* MS.

Hab.—On shells and zoophytes from deep water frequent ; and sometimes on rocks and sea-weeds at low-water mark.

Polypidom like a little saucer, calcareous, white, about half an inch in diameter ; the base thin, subcircular, forming a shallow cup crowded with cells in the centre, the margin plain, entire, scored with faint lines ; central cells shorter than those towards the circumference and frequently closed, most of them laid obliquely, but some erect, tubulous, with a round even aperture.—In its perfect state this pretty zoophyte has been aptly compared to a compound flosculous flower. It varies a good deal in the deepness of its centre, for sometimes it is properly described as being cupped, at other times it is so shallow that a saucer or plate becomes the best object of comparison. The centre of the disk, opposite the place of the soldering of the polypidom to its foreign base, is without tubes or cells, which are in lined series, and are arranged very prettily round the circumference of the saucer, but the series nearest the margin are irregular and coalescent, with plain angular apertures, so as to resemble exactly a piece of honey-comb. The rowed and more inward cells, are on the contrary tubular, often free and disjunct, and stand in regular lines. The margin is formed by an extension of the basilar lamina. Specimens occur in which it scarcely protrudes beyond the mass of cells, but generally it is about a line in breadth, and, when seen through a good magnifier, appears scored with opake and transparent lines.—The polypes are unknown.

Of the variety *bellis* Mr. Thompson has favoured me with the following description. Its peculiarities seem to be dependent on its position being unfavourable to the perfect development of the zoophyte.

" Polypidom calcareous, snow-white, about three lines in diameter ; base very thin, circular, flat. Not much elevated above this, the cells, generally placed obliquely, exhibit a flattish circular mass, in disposition and form resembling those in the *centre* of Tubulipora patina, but are more developed and distinctly shown throughout than in that species.

" This beautiful Tubulipora occurred to me in Strangford Lough sparingly studding, with circular patches of a snow-white colour,

some Zostera marina that had been cast ashore. It is consequently an inhabitant of shallow water.

"This species ? is like what the central portion of Tubulipora patina would be if set on a flat base and wanting the marginal series of erect tubes. In the course of drying the Zostera containing this zoophyte, (and which was done very gradually in a cool place,) the specimens of Tubulipora bellis dropped off from their fragile base, which still remained attached to the plant." *W. Thompson.*

2. T. HISPIDA, *sessile, "margin thin and waved, the cells distributed or radiated, with denticulated orifices."* Rev. Mr. Cordiner.*

PLATE XLVII. FIG. 9, 10, 11.

Madrepora verrucaria, *Fabric.* Faun. Groenl. 430. *Esper* Madrep. tab. 17, fig. *d, D; e, E;* and *F, G.*—"Coral resembling the cups and foliage of flowers, *Cordiner*'s Ruins, No. xxii." on the authority of *Fleming.*—Discopora hispida, *Flem.* Brit. Anim. 530. *Blainv.* Actinol. 446. *Johns.* Brit. Zooph. 270, pl. 31, fig. 9—11. *Thompson* in Ann. Nat. Hist. v. 253. *Hassall* in ibid. vi. 171. *Couch* Zooph. Cornw. 47: Corn. Faun. iii. 109, pl. 19, fig. 1.

Var. β. smaller, base circular, the centre orbicular.—Tubulipora orbiculus, *Lam.* Anim. s. Vert. ii. 163: 2de edit. ii. 243.

Hab. Parasitical on Flustræ, on sea-weeds, (chiefly Delesseriæ and Nitophyllæ) on shells and rocks. "On a plant of Griffithsia setacea I have an interesting specimen, in which, as if from want of room to fully expand itself, the polypidom assumes above the form of a double circle, and the marginal base folds in, so that taken altogether, we have somewhat the appearance of the scroll or volute of an Ionic pillar," *W. Thompson.* Similar specimens are not rare on Sertulariæ, and narrow-leaved sea-weeds. In Mr. W. Thompson's herbarium, there are specimens on various species of Algæ from Van Diemen's Land.

"Breadth nearly an inch, hispid; the cells seem distributed over the whole surface, and more vertical than the preceding *(T. patina)*; there are, however, waved porous grooves, and the cells seem disposed on each side of these in irregular transverse rows, united or free, short, with expanding orifices, dividing into irregular spinous processes." *Fleming.*

* He was "Minister of the Episcopal chapel at Bamff." Encouraged by Pennant, he published two volumes illustrative of the Antiquities of Scotland. In one of these, entitled "Remarkable Ruins," he gave figures of several Scottish animals but without descriptions, "in illustration of the designs of his pencil." Fleming, Brit. An. p. 504. I have not seen this work.

The appearances which this species assumes under different circumstances are so distinct and dissimilar that, without an examination of many specimens, we might readily be led to make two species of them. In what I consider to be its most perfect condition the Polypidom is wart-like, white and calcareous, the surface convex approaching to hemispherical, with the tubular cells radiating from the dimpled centre in rows separated by cellular or reticulated grooves. The tubes near the circumference are closely compacted, those in the centre more loosely, and, from their position, necessarily free or disjunct at one side, along which there runs a series of spines similar to those that are on the mouth. These pretty specimens have a circular base, and rarely exceed the third of an inch in diameter. They have some pretension to be compared to a madrepora,—the elevated rows of tubes representing the radiating lamellæ, and the depressed cellular furrows the interlamellar spaces. These constitute the most remarkable peculiarity of this Tubulipora, and appear to be formed by a coalescence of the spines of adjacent tubes into a sort of net-work with round or angular meshes,—affording in this structure a good demonstration of the organic nature of the polypidom.

In its other most marked state the polypidom forms a circular saucer-like crust, sometimes not much less than an inch in diameter, and bounded by a thin narrow margin. The surface is plain, or only slightly convex, with little elevated roundish spots scattered over it, or waved with transverse ridges. The cells are erect, very close or coalescent, and not distinctly rowed, so that the reticulated spaces become obscure or obsolete, and the spines along the sides cannot be produced. There are three minute denticles on one side of the apertures, of which the central one is largest, and to see them aright it is often necessary to view the specimen obliquely; but in other specimens growing under shelter, the denticles become elongated into strong sharp spines, rendering the surface quite hispid to the naked eye.

The description of Otho Fabricius is excellent:—"Diam. 2 lines. —Variat albus, vel flavicans. Tubuli disci per radios plerumque dispositi, versus limbum vero magis aggregati, subcompressi, apice acuminati in aculeos 2 vel 3 divisi superficiem echinatam reddunt. In aliis interstitia radiorum integra; in aliis, et quidem majoribus, porosa, quasi reticulata.

"Habitat in plantis marinis et cellulanis variis, quibus planitie sua inferiore adhæret, frequens satis.

"Varietas flavicans in ulvis præsertim obvia, in quarum foliis impressiones orbiculares relinquit. Si ramulis tenellis affixa sit, aut circum illos convoluta, cylindrum s. annulum oblongum format, aut duæ oppositæ annexæ ramulum inter se servant."

The figures of Esper, quoted by Lamarck for his T. orbiculus, represent *Cellepora pumicosa;* and Blainville informs us that the specimen in Lamarck's collection is an arborescent, more or less branched, spongy mass composed entirely of cells, and can only be a variety of a Cellepora. It is unnecessary to point out the incongruity between this and Lamarck's description, which is referable only to a true Tubulipora, and suits the species before us remarkably well: "T. subincrustans; cellulis tubulosis in orbiculum hemisphæricum aggregatis; osculo subdentato." The orifice of the aperture being sometimes, as Lamarck says, furnished with from one to three teeth, and sometimes with none, is exact to T. hispida; and the character proves that the species can be no variety of *T. verrucosa* as Milne-Edwards has conjectured.

Old and dead specimens often have the appearance of the fossil Favosites.

* * Base elongated or incrassated.

3. T. PENICILLATA, *stalked, the stalk cylindrical, expanding into a round celluliferous head; cells tubular with a plain even aperture.* R. Q. Couch.

PLATE XLVIII. FIG. 1, 2.

Tubipora penicillata, *Fabric.* Faun. Groenl. 429. *Turt.* Gmel. iv. 615.—Tubulipora Fungia, *Couch* Zooph. Cornw. 46: Corn. Faun. iii. 107, pl. 19, fig. 3.

Hab. "On shells and stones from deep water, common; from the Eddystone lighthouse to the Deadman Point," *R. Q. Couch.*

Polypidom fixed by a small disk, stalked, the stalk cylindrical, striate, expanding into a peziza-like head on which the tubular cells open: these are coalescent and aggregated round the circumference, but the more central ones are either scattered or arranged in imperfect rows, and near the centre they often stand separate; their upper half of the tube is usually free, and the walls are minutely granulous; the aperture circular and plain. There is in some specimens a very narrow rim around the head enclosing the tubes. Height three lines; breadth of the celluliferous disk sometimes about the same, but generally not more than the half.

"It is calcareous, and about a quarter of an inch in height. The

upper portion is expanded into a flat head, having on its superior surface, one or two rows of projecting tubes round the circumference, the centre is either plain or marked with a few irregular cells. The cells are distant from each other, with slightly oblique unarmed apertures. The under surface of the head is furrowed, without cells, and sloped into the foot-stalk." *R. Q. Couch.*

4. T. TRUNCATA, *mammiform, entirely cellular, the top somewhat enlarged with radiating furrows.* Jameson.

PLATE XXXIII. FIG. 8—10.

Millepora truncata, *Jameson* in Wern. Mem. i. 560.—Tubulipora truncata, *Flem.* Brit. Anim. 529.

Hab. Shetland Islands, *Jameson.* In deep water, Zetland, *Fleming,* whence I have seen specimens dredged by *Professor Edward Forbes.*

"About an inch in height, the branches scarcely exceeding one-eighth; the branches are short, pierced by numerous pores, the openings of cells converging towards the centre; the head is stellate, the rays are highest in the middle of their course, diminishing towards the centre and lower margin of the head; each ray is compressed, and consists of two rows of tubular cells, united, crowded, with subangular orifices; the tubes have a central direction, and give to the sides of the plates a striated appearance. This species has probably been referred to as an inhabitant of the north seas, under the title of Millepora truncata, but it differs widely from the Myriozoos of Donati, to which the term was restricted by Pallas." *Fleming.*

Polypidom a calcareous white and porous mass, mammiform, adherent by an expanded base, enlarged above, the top convex, orbiculated, furrowed with shallow grooves which run in a radiating manner to the flattish summit. There are about 15 of these grooves, which vary in distinctness, and they terminate on the polypidom where the circumference is greatest, and where the roundness of the upper part begins. The whole surface is equally porous or alveolar, the pores just visible to the naked eye, arranged in the manner of the cells in the honey-comb, pentagonal, nearly of the same size, the walls even and smooth. Height about two-tenths, and of nearly the same diameter.

T. truncata has been described as being branched, which it never truly is, but two or three individuals may grow upon a primary polypidom, so closely together that they coalesce at the base; and dying, new corals rise from the dead individuals, and thus give the

polypidom a branched or rather nodulous aspect. The new growths are easily distinguished by their whiter colour.

This pretty coral, when simple, has a great resemblance to a little sea-egg (Echinus) bleached and deprived of its spines, and which has got accidentally fixed on a short stout pedicle : or, in respect of form, it may be compared to a corn-stalk in miniature. It is a solid coral, without any rays or plaits in the cells, which cover the whole polypidom, and extend even over its expanded basis. The resemblance between it and the Lymnorea mamillosa of Lamouroux (Blainv. Actinol. p. 541, pl. 74, fig. 4.) is very remarkable, but Blainville informs us that the latter is a sponge, so that the resemblance is merely in outward show. There is a nearer affinity to some species of fossil Calamoporæ, as for example to the Calamopora parasitica of Phillips (Illust. Geol. Yorks. part ii, p. 201, pl. 1, fig. 61, 62). And Professor Forbes writes me that Goldfuss has figured two Maestricht corals from the upper chalk, under the names of *Ceriopora stellata* and *C. diadema* (Pl. xi, fig. 11, and 12), which are closely allied to it. Mr. Forbes has an undescribed British chalk species of the same group.

* * * Polypidom lobed: base unmargined.

5. T. LOBULATA, "*polypidom six-lobed; cells irregular, united.*" A. H. Hassall.*

Tubulipora lobulata, *Hassall* in Ann. and Mag. Nat. Hist. vii. 367, pl. 10, fig. 1, 2.

Hab. Dublin bay, *A. H. Hassall.*

"Polypidom divided into six lobes of unequal size; tubes joined, of irregular form and size.—Of the above *Tubulipora* I have met with but a single specimen; its appearance and development, however, is so different from any hitherto described, that I conceive myself justified in considering it to be a distinct species." *A. H. Hassall.*

Mr. W. Thompson regards this production simply "as a very aged individual of T. serpens, which had lived long enough to 'describe a circle' with its arms. Specimens are before me with one, two, three and four expansions of a similar nature in all respects to the six of T. lobulata."—In corroboration of this opinion Mr. Thompson has sent me a specimen which grows on the inner surface of a Pullastra,

* The author of "A History of the British Fresh-water Algæ," 2 vols. 8vo. Lond. 1845 : and of some Zoological and Botanical essays in the Annals of Natural History. The genus *Hassalia* of Berkeley is the reward of his services to science.

and it is difficult to give a "not content" to his conclusion. The polypidom is entirely adherent to the surface of the shell, and the segments, parting from a narrow origin, expand into large rounded lobes. In the form and arrangement of the tubular cells there is a close resemblance to Tubulipora serpens, but their medial division is either obscure or unobservable. I have since procured a specimen in Berwick Bay which gives additional strength to Mr. Thompson's view.

6. T. PHALANGEA, *circular, obsoletely lobed, with a mesial division down the middle of each lobe; tubes slender, suberect, irregularly rowed.* W. Thompson.

PLATE XLVI. FIG. 1, 2.

Tubulipora phalangea! *Couch* Corn. Faun. iii. 106, pl. 19, fig. 7.—Tubulipora verrucaria? *M. Edwards* in Ann. des Sc. Nat. n. s. viii, 323, pl. 12, fig. 1. *Hassall*(?) in Ann. and Mag. N. Hist. vi, 171, pl. 6, fig. 3, 4; and (!) vii, 366.

Hab. On rocks, shells and shell-fish, corallines and Laminariæ, not rare. "It appears to luxuriate in the bulb of Laminaria bulbosa, where it is fine indeed," *C. W. Peach.*

Polypidom spreading circularly, 4 lines in diameter, somewhat lobed, and usually pentapetalous, of a very pale purple colour, the base entirely adherent, thin, and without any visible margin: Polype-tubes diverging from the centre, divided down the middle of each lobe into two sets marked by their inclination outwards, irregular, running into lines, and very decidedly so at the circumference, where they are crowded and almost horizontal; the tubes slender, somewhat flexuous, thin and vitreous, with an even entire aperture.

"The tubes are comparatively long, and are not in contact with each other as viewed from above. They are numerous and arranged in perpendicular rows; each row is formed of a single series of tubes, which are in contact with each other; each being united to the one above and below. This arrangement presents the appearance of a number of Pan's pipes placed perpendicularly, the sets being separated from each other." *R. Q. Couch.*

When mature this fine Zoophyte resembles, as Mr. Hassall has aptly said, "in outline a pentapetalous flower, being slightly five-lobed." Mr. Peach has seen it nearly an inch in diameter, and he tells me that, in its beginning, it is fan-shaped, and generally parts into two lobes dilating outwardly. I can scarcely doubt of the identity of this lobed polypidom with the Tubulipora verrucaria of Milne-Edwards, which is apparently not lobed, for I have seen small

specimens with a close resemblance to his principal figure (see Plate XLVI, fig. 3, 4.); and I have seen others very exact to those monstrosities of the species which he has so beautifully pourtrayed. In unfavourable situations T. phalangea assumes sometimes the shape of an irregular wart, on which we may observe the tubes in one place scattered and almost free, and either erect or sub-flexuous; in another place joined in short rows with apertures that scarcely project beyond the crust, which has undergone an unnatural development and thickening. But I have dropt the specific name *verrucaria*, because I believe Milne-Edwards to be wrong in his synonymes, and because the name has been now applied to so many things as to render its retention unadvisable.

7. T. FLABELLARIS, *crustaceous, fan-shaped, adnate; the polype-tubes laid horizontally, rather short, with a plain entire aperture.* W. Thompson.

PLATE XLVI. FIG. 5, 6.

Tubipora flabellaris, *Fabric.* Faun. Groenl. 430. *Turt.* Gmel. iv. 615.—Discopora palmata? *Risso* l'Europ. mérid. v. 339.

Hab. On the leaves of the Laminariæ on the Irish coast, *W. Thompson.*

Polypidom forming a calcareous fan-shaped spot, from one to three lines in diameter, adherent by a thin plane lamella, of which the margin does not jut beyond the tubular cells: these are horizontal, sub-alternate, obscurely rowed, sometimes vitreous and transparent, at other times opaque and wrinkled. It differs from the preceding in its form, which imitates the "Prince of Wales' feather;" in the want of a division down the lobes; and in the horizontal disposition of its tubes, which are also comparatively short, and of somewhat larger bore.

I owe all my knowledge of this species to Mr. W. Thompson, who sent specimens to me under the name of *Tubulipora plumosa.* "It forms," says Mr. Thompson, "a beautiful incrustation, which takes the figure of a feather or of several feathers combined, and is of a dull opaque white colour, except at the margin, where the tubes are somewhat transparent, and delicately tinged with pale lilac. The tubes are transversely wrinkled or ridged, — an appearance which increases more than in a regular ratio as the species approaches a perfect state: the space between the tubes is likewise rugose. None of my specimens exceed one-third of an inch in diameter."—"The delicate, smooth, and somewhat hyaline speci-

mens which I obtained on the beach at Bangor, co. Down in 1833, and subsequently dredged in the loughs of Strangford and Belfast, are regarded by me as identical in species with the large greyish-white and rugose forms procured on the open coast of Down at Ballywalter. Examples precisely similar to the latter, are on Algæ in my collection from Van Diemen's Land." *W. Thompson.*

8. T. SERPENS, *depressed, dichotomously divided, the segments free and truncate ; polype-tubes in transverse rows, divided by a longitudinal mesial line.* Ellis.

PLATE XLVII. FIG. 4, 5, 6.

Small purple Eschara, *Ellis* Corall. 74. No. 6, pl. 27, *e*, *E.* copied in Ann. des. Sc. Nat. n. s. viii. pl. 12, fig. 2.—Tubipora serpens, *Lin.* Syst. edit. x. 790. *Lin.* Syst. 1271. *Turt.* Gmel. iv. 614. *Jameson* in Wern. Mem. i. 561. *Stew.* Elem. ii. 426. *Bosc* Vers. ii, 351.—Millepora liliacea, *Pall.* Elench. 248. *Turt.* Gmel. iv. 639. *Turt.* Brit. Faun. 205. *Bosc* Vers. ii, 345.—Millepora tubulosa, *Ellis* and *Soland.* Zooph. 136. *Turt.* Gmel. iv. 639. *Turt.* Brit. Faun. 205. *Stew.* Elem. ii. 428. *Bosc* Vers. ii. 345. *Hogg's* Stock. 37.—Cellepora ramulosa, *Esper* Pflanz. Cellep. tab. 5.—Tubulipora transversa, *Lam.* Anim. s. Vert. ii. 162 : 2de edit. ii. 242. *Risso* l'Europ. Mérid. v. 338. *Lamour.* Expos. Method. 1. pl. 64, fig. 1. (copied from Ellis.) *Stark* Elem. ii. 437. *Johnston* in Trans. Newc. Soc. ii. 269. *Blainv.* Actinol. 424.—Obelia tubulifera, *Lamour.* Expos. Method. 81, tab. 80, fig. 7, 8. copied in *Blainv.* Actinolog. 424, pl. 71, fig. 1 ; and in Ann. des Sc. Nat. n. s. viii. pl. 12, fig. 3. *Lam.* Anim. s. Vert. 2de edit. ii. 246.—Tubulipora foraminulata, *Blainv.* Actinol. 425, pl. 62, fig. 3, 3a. (not of Lamarck.)—Tubulipora organisans, *D'Orbigny.*—Tubulipora serpens, *Flem.* Brit. Anim. 529. *Couch* Zooph. Cornw. 45 : Corn. Faun. iii. 105, pl. 19, fig. 6.—Idmonea transversa, *M. Edwards* in Ann. des Sc. Nat. n. s. ix. 218, pl, 9, fig. 3.—Pherusa tubulosa, *Templeton* in Mag. Nat. His. ix. 469,—on the authority of *W. Thompson* in Ann. Nat. Hist. v. 252.

Hab. Common on all parts of the coast, adherent to flexible zoophytes, the Sertularinæ of deep water especially ; to old shells, and oftenest within old bivalves ; and to algæ. "Ex mari Cornubiam alluente allatæ Sertulariæ eandem crebram, in piso majores glomeres convolutam aut laciniosos passim et revolutos flosculos mentientem exhibuerunt," *Pallas.*

Polypidom adherent by a narrow base, calcareous, of a faint purple colour or white, depressed, irregularly divided, the segments flat, bifid, spreading, more or less revolute, obtuse, the under surface even and striate, the upper rough with the tubulous cells arranged prettily in transverse rows, but divided by a central groove, which winds along the branches : the cells are generally placed in close apposition, sometimes they are disjunct, and the walls are minutely frosted.

—The entire polypidom rarely exceeds half an inch in length, but when perfect the branches are bent and intertwined so as to form a little glomerous mass.

"Incipit semper duplici lacinia, veluti furca, obliqua a rupe aliave cui insidet basi prodeunte. Laciniæ nunquam 2 lineis paris. longiores observantur." *Pallas.*

Milne-Edwards is of opinion that the T. serpens of O. Fabricius is not synonymous with the Linnæan species, but with the T. fimbriata of Lamarck, in which opinion a re-perusal of the description, in the Fauna Grœnlandica, does not induce me to coincide.

Our species is without any doubt the same as the Idmonea transversa of Milne-Edwards, but it cannot, in our opinion, be separated generically from T. phalangea and flabellaris. Indeed monstrous specimens are sometimes met with which can with certainty be referred to neither of these species, except by reference to specimens of a more normal character on the same site.

I have seen small specimens on crabs and shells which correspond exactly with the figure of Lamouroux's Obelia tubulifera, which I consider to be Tub. serpens in an early state of existence, evolving itself on the flat and even surface of a bivalve shell.

9. T. hyalina, "*encrusting, semi-transparent, membrano-calcareous; cells distant from each other, tubular, erect, arranged in one or two circular rows round a plain centre; apertures unarmed and frosted.*" R. Q. Couch.

Tubulipora hyalina, *Couch* Zooph. Cornw. 47: Corn. Faun. iii. 108.

Hab.—"On Fucus palmatus, rare. Polperro," *R. Q. Couch.*

"Encrusting in small semi-transparent patches of about the diameter of a pea. The cells are distant, erect, arranged in one or two rows round a plain centre; occasionally there are a few cells irregularly arranged in a circumscribed patch in the centre, but separated from the external rings by a plain surface. The apertures are even, unarmed, with frosted rims." *R. Q. Couch.*

2. Diastopora,* Lamouroux.

Character.—*Polypidom calcareous, encrusting, undefined; the cells alternating, tubular, horizontal, immersed, with a raised circular aperture.*

* As defined by us, the genus corresponds with the "Les Diastopores simples" of Milne-Edwards. Mem. p. 39.—The name appears to signify "having pores at intervals," from διάστημα an interval, and πορος a passage.

1. D. OBELIA, *crust thin, closely adnate ; cells with an even entire aperture.* Dr. Fleming.

PLATE XLVII. FIG. 7, 8.

Millepora reticulum? *Esper* Millep. tab. 11, fig. 1, 2.—Berenicea hyalina, *Flem.* Br. Anim. 533.—Obelia tubifera, *Gray* Zool. Misc. 35.—Tubulipora obelia, *Johns.* Brit. Zooph. 269, pl. 30, fig. 7, 8. *Couch* Zooph. Cornw. 47 : Corn. Faun. iii. 108. *Thompson* in Ann. Nat. Hist. v. 252.

Hab.—In deep water at Scarborough, on Modiola vulgaris, rare, *W. Bean.* I find it on the same shell in Berwick bay, *G. J.* Common on shells and stones on the coast of Cornwall, *R. Q. Couch.* Not uncommon in Devon, *C. W. Peach.* Shores of Ireland, *W. Thompson.* I have seen several specimens on Lima fragilis dredged off Sana Island by Mr. Hyndman and in the collection of *Mr. Thompson;* and have had it also from the *Rev. D. Landsborough.* It has a preference to the Pinnæ.

Crust rather thin, entirely and very closely adherent, chalk-white, even, spreading in somewhat circular expansions : the cells alternate, rather distant, rowed, radiating from several centres, divided by paler lines, horizontal, tubulous, mostly immersed, the mouths raised with a round oblique plain aperture.

"The tubes or cells," Mr. Couch has correctly remarked, "vary very much in their appearances, being either erect, semi-erect, prominent, or immersed, and in some specimens all these varieties occur together." In general, however, they are much more immersed in the crust than is usual in the Tubuliporidæ, and instead of their elevated apertures opening on a line so as to form a transverse series, they are pretty constantly alternate. The basal lamina extends a narrow thin border beyond the cells, and is so cemented to the shell on which it grows that it cannot be detached without destruction.

This polypidom has great resemblance to the D. verrucosa and gracilis of Milne-Edwards, especially to the latter (See Ann. des Sc. Nat. n. s. ix, pl. 14, fig. 2 and 3.), from which, indeed, I know not how to distinguish it. The D. gracilis is a fossil ; and, besides it, we have five other native fossil species.

3. IDMONEA,* Lamouroux.

CHARACTER.—*Polypidom calcareous, divided dichotomously,*

* Idmonea, probably from Idmon, one of the Argonauts, who acted as prophet to the expedition. Ἰδμων, knowing, sagacious.

erect, celluliferous on one side only; cells tubular, in transverse rows, divided into two sets by a medial longitudinal line.

1. Id. atlantica, *branches roundish, tapered to the point; cells four in each row, the innermost tubes considerably protruded.* E. Forbes.

Plate XLVIII. Fig. 3, 3.

Idmonea atlantica, *E. Forbes*, MSS.

Hab.—Zetland seas, *E. Forbes.*

Polypidom neat and erect, of a white colour and firm texture, dichotomous; the branches spreading laterally, narrow, roundish, tapered to the point; inferior surface somewhat convex, smooth, pitted or areolar; superior surface celluliferous, the cells tubular, forming a neat series of transverse rows on each side of the coral, the rows of one side alternating with those of the other, and there are four tubes in each row, the free extremities of the innermost tubes being the longest. Height four-tenths.

Of the species described by Milne-Edwards, this approaches nearest to the *Id. coronopus* of Defrance (Mem. p. 23, pl. 12, fig. 3), from which it seems to differ only in the cylindrical form of its branches, that of the Id. coronopus being triangular.

Idmonea atlantica is one of the numerous discoveries of Professor Edw. Forbes, to whom I am indebted for my specimens. He has another recent species from the Ægean sea, very nearly related to the atlantica; and in the collection of Mr. Stokes there is one from Kamschatka. "They appear," says the Professor, "to be very characteristic of great depths; and when found fossil, as in the chalk,—at the junction of the chalk with flints and that without,—are always associated with deep sea-forms of Mollusks and Radiata."

4. Pustulipora,* Blainville.

Character.—*Polypidom calcareous, erect; the divisions cylindrical; polype-cells semi-immersed, arranged on all sides, tubular, with more or less prominent apertures.*

1. P. proboscidea, *slender, branched alternately; tubular cells slightly projecting, alternate, four completing a whorl.* E. Forbes.

* Formed from *pustula* and πορος, having the pores on pustules.

Plate XLVIII. Fig. 4, 4.

Pustulipora proboscidea, *M. Edwards* Mem. 27, pl. 12, fig. 2.

Hab.—Zetland seas, *E. Forbes.*

Polypidom calcareous, erect, about half an inch in height, smooth, white, branched, the branches cylindrical, slender, alternate, erecto-patent, pointed; cells nearly immersed with everted free tubular extremities, alternate, four completing a whorl, the aperture with a slight mucro on the outer edge.

2. P. deflexa, "*polypidom erect, cylindrical, with waved tubes projecting from all parts.*" R. Q. Couch.

Plate XLVIII. Fig. 5, 5.

Tubulipora deflexa, *Couch* Zooph. Cornw. 46: Corn. Faun. iii. 107, pl. 19, fig. 4.

Hab.—"On shells from deep water, common. Polperro, Mevagissey Bay, and off the Deadman Point," *R. Q. Couch.* Plymouth, *J. C. Bellamy.*

"This species is very common; it varies in height from one quarter to half an inch. It is calcareous, white, cylindrical, with sometimes an enlarged globular head. The tubes are from all parts of the polypidom, and greatly project in a waved form; they are shorter above than below, and their apertures are even and unarmed. The base is slightly spreading and of a darker colour than the upper portions." *R. Q. Couch.*

I have specimens of this from Mr. Couch and Mr. Bellamy. Some are simple and some are divided once bifidly, and one is of a horn colour. It is of rather a friable texture, and the entire surface is frosted or closely speckled with minute granules. The cells are numerous and irregular, and their free part varies considerably in length.

I am tempted to ask whether this may not be a state of Tubulipora serpens? The latter is happily named, at least in the poetical sense, for it seems to have beguiled us to make not less than four species out of its guises:

"himself now one,
Now other, as their shape serv'd best his end."

5. Alecto,* Lamouroux.

Character.—*Polypidom calcareous, creeping, entirely adnate, irregularly branched, formed of horizontal tubular cells produced in a linear series, the upper portion of the cell erect with a circular entire aperture.*

1. A. granulata, *cells uniserial, their parietes granulous.* W. Thompson.

Plate XLIX. Fig. 1, 2.

Alecto granulata, *M. Edwards* Mem. p. 13, pl. 16, fig. 3, 3.—Tubulipora trahens, *Couch* Zooph. Cornw. 45: Corn. Faun. iii. 105, pl. 19, fig. 5. (not good).

Hab.—On the inner surface of old bivalve shells, not uncommon; more rarely on stones, and on the outer surface of shells. It is apparently a deep-water species.

Polypidom confervoid, slender, more or less branched, entirely adherent, branches irregular, usually patent, sometimes anastomosing, consisting of a single series of tubular cells, leaning almost imperceptibly to opposite sides, the upper half becoming suddenly erect and free, with a circular even aperture. The whole polypidom is frosted or minutely granulous, and the walls are vitreous, except in dead specimens, which sometimes become opake-white.

The base or adhering part of the polypidom is very slightly dilated. The horizontal portion of the cell is enlarged almost imperceptibly upwards until where the upper portion rises abrupt, and this is rather narrower and quite cylindrical. The mode of ramification is very various. Specimens of this kind often occur: there is a long line of single tubes, with a branch or two of the same character, when a portion succeeds with two cells opening side by side, then perhaps three in a row, and the branch terminates in a dilated end. Sometimes the cells are scattered and almost disjunct, forming a rude circular patch; but even in this form it is known by the peculiar character of the tubes, half horizontal and half erect.

* Alecto, one of the Furies, having serpents round her head instead of hair. Virgil (Æn. vii. 327, &c.,) thus describes her:—

"Odit et ipse pater Pluton, odêre sorores
Tartareæ monstrum: tot sese vertit in ora,
Tam sævæ facies, tot pullulat atra colubris."

The Alecto granulata of Milne-Edwards is a fossil, but I can discover no difference between it and our recent species.

2. A. MAJOR, *cells biserial or triserial, immersed, smooth.* Rev. D. Landsborough.

PLATE XLIX. FIG. 3, 4.

Tubulipora repens? *S. V. Wood* in Ann. and Mag. N. Hist. xiii. 14.

Hab.—On stones and old bivalve shells from deep water, not rare.

Polypidom calcareous, branched, very closely adherent, the basis somewhat dilated or effused, white and vitreous, scored with faint lines longitudinally, marking the septa of the tubular cells, which are in one, two or three series, entirely immersed in the crust, except towards the extremity which is suddenly raised into a short cylindrical tube with a circular plain aperture.

This is a much stouter species than the preceding, and the surface is scarcely if at all granulous. It is very irregularly branched, the branches being almost always expanded or clavate at their ends; and hence young or unbranched specimens have the figure of a tear that trickles slowly down the cheek,—an apt comparison, which I steal from my friend the Rev. D. Landsborough. It adheres very firmly to its foreign basis, for the basal portion of the polypidom itself is somewhat effused, so that the cells lie, as it were, upon and in this crust, showing themselves only by their raised tubular apertures, which open usually two or three together in a cross line, although in some parts there is one only.

I cannot reconcile this species with any described by Milne-Edwards. It was first sent to me by the Rev. D. Landsborough under the name of Alecto dichotoma? I then received several specimens from W. Thompson, Esq., dredged off Sana Island; and subsequently Mr. Couch sent it as his Tubulipora trahens, at the same time remarking that the specimens were not good representatives of that species. Whether it is a state of T. trahens or not I will not decide, but the two appear to me to be specifically distinct. The A. major differs from A. granulata in its superior stoutness and breadth, in its firmer adherence to its site, in the less elevation of the ends of its tubes, and in the want of granules on the surface of the polypidom. These characters may vindicate its specific rank. See page 82.

3. A. DILATANS, *branched, branches dilated at the ends; cells multiserial, the parietes granulous.* W. Thompson.

Plate XLIX. Fig. 5—8.

Tubulipora palmata? *S. V. Wood* in Ann. and Mag. N. Hist. xiii. 14.

Hab.—On old bivalve shells from deep water dredged off Sana Island by Mr. Hyndman, *W. Thompson*. Coast of Northumberland, *W. King*. Dredged in from 110 to 140 fathoms off the Mull of Galloway, *E. Forbes*.

A fine species which creeps over the surface of bivalve shells in a dendritical fashion, the branches a line or more in breadth, gradually enlarging to the end so as to assume a clavate form; and hence a single branch, like that of the preceding, takes the figure of the tear that has been arrested in its course. The polypidom is closely adherent by an expanded base; the branches are rounded or convex superiorly; the cells tubular, horizontal, semi-immersed, their septa marked by pale lines, their parietes vitreous and granulous, the aperture very little raised, oblique, and entire. These openings are crowded at the extremity of the branches.

This description is made from a specimen that had selected the outer side of Tellina crassa for its site; but another, which I think is referable to the species, on the inner and smooth surface of the Venus ovata, is still more beautifully ramified, and the divisions are broader and flatter, palmate at the ends, while the upper portion of the cells is abruptly erect and free, as in the genuine Alectos. This is what I suppose may be identical with the Tubulipora palmata of Mr. Wood; and I have sometimes thought that it might be a state of Diastopora obelia. The student will occasionally find it not easy to define the limits either of the genera or species in this family; and I would advise his examination to be limited to what appear to be well developed and perfect specimens.

On the outer surface of a Lima from the Isle of Man, sent to me by Professor E. Forbes, there is an Alecto which I have scarce a doubt is identical with the *A. gracilis* of Milne-Edwards. (Mem. p. 15, pl. 16, fig. 2.) The specimen, however, is not sufficiently perfect to admit of its being figured correctly.

FAMILY—CRISIADÆ.

Les Crisies, *Milne-Edwards* Mem. p. 1-13.

Character.—*Polypidoms phytoidal, jointed, dichotomously branched; the cells tubular, disposed in one or two series with the circular apertures alternately looking to opposite sides.*

The true position of this family in its class was first perceived by

Milne-Edwards. The Crisiadæ differ from the Tubuliporidæ in external form only, evolving not in little crusts or wart-like masses, but in neat confervoid tufts of ivory whiteness, which often confer additional beauty to the sea-weeds they infest. The polype is an ascidian of the normal structure, but yet examined in only one or two species. On the polypidom may frequently be seen pear-shaped vesicles of the same texture as the polype-cells, and very like the ovarian vesicles of the Sertularinæ, (Fig. 62 and 63,) but that the use of them in the two tribes is the same cannot be said to be yet determined. No other Polyzoan possesses them.

Fig. 62.

Fig. 63.

6. Crisia,* Lamouroux.

Character.—*Cells in two rows, subalternate ; the aperture entire and terminal.* Fig. 62.

1. C. eburnea, "*cells loosely aggregated, cylindrical, bent, tubular, orifices free.*" Ellis.

Plate L. Fig. 3, 4.

Tufted Ivory Coralline, *Ellis* Corall. 39, no. 6, pl. 21, fig. *a*, *A*.—Sertularia eburnea, *Lin.* Syst. edit. x. 810. *Lin.* Syst. 1316. *Esper* Pflanz. Sert. tab. 18, fig. 1-3. *Berk.* Syn i. 220. *Turt.* Gmel. iv. 686. *Jameson* in Wern. Mem. i. 565. *Turt.* Brit. Faun. 217. *Stew.* Elem. ii. 449.—Cellularia eburnea, *Pall.* Elench. 75. Hogg's Stock, 35.—La Sertolara d'avorio ? *Cavol.* Pol. Mar. 240, tav. 9, fig. 5, 6.

* From Κρίσις, separation.

—Cellaria eburnea, *Ellis* and *Soland.* Zooph. 24. *Bosc* Vers. iii. 133. *Lam.* Anim. s. Vert. ii. 138: 2de edit. ii. 184. *Johnston* in Trans. Newc. Soc. ii. 262, pl. xi. fig. 5.—Crisia eburnea, *Lamour.* Cor. flex. 138. Corall. 60. Expos. Method. 6. *Flem.* Brit. Anim. 540. *Templeton* in Mag. Nat. Hist. ix. 468. *Blainv.* Actinolog. 460, pl. 78, fig. 3. *Risso* l'Europ. Mérid. v. 313. *Couch* Zooph. Cornw. 41: Corn. Faun. iii. 99, pl. 18, fig. 2.

Hab.—Parasitical or sea-weeds and on other Zoophytes, very common. "This species appears on algæ from California in my collection," *W. Thompson.*

Grows in little bushy tufts of ivory whiteness, frequently tinted with rose-red, from a quarter to fully an inch in height, attached by a few capillary fibres dilated at their points of insertion into minute calcareous bulbs. Polypidom much branched, the primary divisions alternate, spreading; the secondary from one side only and bending inwards with a slight curve. Cells in two rows, semi-alternate, sometimes nearly opposite, tubular but narrowed at the base, the walls transparent and granulous, the aperture circular, somewhat oblique, with an even and entire rim. There are from two to five, sometimes seven and very rarely even nine, cells in each internodial space, the articulation itself being short and flexible. The ovarian vesicles are pear-shaped, granulous, sparingly produced, and scattered on the polypidom.

Under a high magnifier the granules of the cells and vesicles have an appearance which induces us to compare them to the stomata on the leaves of plants. They are, as my friend Mr. T. G. Ryland correctly advises me, oval in form and arranged lengthwise on very fine lines or striæ; and so set that the granules of one line alternate with those of the next to it. Whether these granules are "vesicular discs," as Mr. Ryland believes, is I think very doubtful; but it may be conjectured that they serve to admit the circumfluent water into the interior of the cell.

2. C. DENTICULATA, "*cells closely aggregated, cylindrical, nearly straight, with short tubular orifices; joints black.*"—Rev. J. Fleming.

PLATE L. FIG. 5, 6.

Cellaria denticulata, *Lam.* Anim. s. Vert. ii. 137: 2de edit. ii. 182.—Crisia luxata, *Flem.* Brit. Anim. 540. *Blainv.* Actinolog. 460. *Johns.* Brit. Zooph. 262. *Thompson* in Ann. Nat. Hist. v. 252. *Couch* Zooph. Cornw. 42: Corn. Faun. iii. 99, pl. 18, fig. 3. *Macgillivray* in Ann. and Mag. N. Hist. ix, 466.—Crisie dentelée, *M. Edwards* in Ann. des Sc. Nat. n. s. ix. 201, pl. 7, fig. 1.—Crisia patagonica? *D'Orbigny.*

Hab. "On corallines, not rare, from various parts of the coast," *Fleming.*

Polypidom erect, about an inch in height, white and calcareous, bushy, dichotomously divided, the branches inclining inwards; the joints jet-black; the internodes narrow at their origin, widened upwards; the cells entirely adnate, tubulous, semi-alternate, thickly specked with granules disposed in rows, the apertures shortly tubular, secund, with a circular even slightly thickened rim.

Though in many respects similar to the preceding, this is yet essentially different, and has been well characterised by Dr. Fleming. It is of a denser texture; the branches, or rather the spaces between the joints, are longer, broader and thicker in the middle; the cells are more closely connected; their orifices are not detached from the sides, and the joints are black, so that the polypidom appears dotted to the naked eye.

3. C. ACULEATA, "*cells disposed in a double series, armed with a long spinous process, joints of an amber colour.*" A. H. Hassall.

Crisia aculeata, *Hassall* in Ann. and Mag. Nat. Hist. vi. 170, pl. 7, fig. 3, 4; and vii. 366.—Crisie ivoire, *M. Edwards* in Ann. des Sc. Nat. n. s. ix. 198, pl. 6, fig. 2.—Crisia eburnea, *Van Beneden* Recherch. 52, pl. 6, fig. 12-16. (Without the spinous processes.)

Hab. Brighton; not unfrequent, *A. H. Hassall;* who subsequently added it to the Irish Fauna, having found it on stones east of Kingstown harbour. On a valve of Pecten maximus dredged between Larne and Glenarm, co. Antrim, *R. Patterson.* Found at Ballantrae, Ayrshire, in 1839; and in Strangford Lough, in October of of the same year, *W. Thompson.*

"Polypidom erect, bushy, about an inch in height, and beautifully frosted; branches alternate, jointed at irregular intervals; internodes narrow at their commencement; cells subalternate, tubular, the majority being furnished with a long spine, which arises from the outer side. Vesicles much resembling a fig in shape, and dotted." *A. H. Hassall.*

"Milne-Edwards has figured this species, which I described in the 'Annals of Natural History' for November 1840, in the 'Annales des Sciences Naturelles' for April 1838, under the name of *La Crisie ivoire.* How Milne-Edwards could have confounded this somewhat rare species with the common one, *C. eburnea,* I am at a

loss to conceive. Upon this latter species in no case have I ever met with spines; and had they existed, traces of them would have been visible on the sides of the cells, as they always are in *C. aculeata*, even when the teeth themselves have been broken off." *A. H. Hassall.*

Of a slenderer habit than C. eburnea, which the species closely resembles; nor can I persuade myself that it is more than a variety, —an opinion in which I am supported by Mr. W. W. Saunders. He writes me, "The Crisia aculeata of Hassall is far from uncommon at Brighton and Hastings. I am very doubtful, however, if the species be a good one, as C. eburnea has the cells sometimes with a spinous process beneath them, as figured in the plate above quoted of the Annales. The spinous character being then not peculiar to C. aculeata, I do not see how it differs from the C. eburnea. I believe M. Hassall's C. aculeata to be the perfect state of C. eburnea." Jan. 5, 1841.

4. C. GENICULATA, *cells alternate, long and tubular, with a plain aperture.* J. J. Lister.

Tibiana, *Lister* in Phil. Trans. an. 1834, p. 385, pl. 12, fig. 5.—Crisia geniculata, *M. Edwards* in Ann. des Sc. Nat. n. s. 9, 197, pl. 6, fig. 1. Mem. 5.

Hab. Parasitical on littoral algæ. Brighton, *Lister;* where it was also found on Rhodomela pinastroides by *W. W. Saunders.* Coast of Ayrshire, plentiful, *Rev. D. Landsborough.* I have Irish specimens from *W. Thompson,* collected in Strangford Lough.

Polypidom rooted by a creeping fibre, confervoid, about half an inch in height, slender, dusky white, irregularly branched, the branches erect, subgeniculate: cells biserial, alternate, each forming a long cylindrical tube, of which the upper half is free and slightly divergent, with a circular plain aperture. Between most of the pairs of cells there is a flexible joint. The walls of the cells are somewhat granulous, and the granules are connected by faint lines.

This differs from C. eburnea in its more slender make and less calcareous texture; in the straightness of its secondary branches; and in the tubular form of the cells, which are distinctly alternate and free at their apices. The granules on the parietes are also smaller and more distant, and the striæ almost obsolete. There is sometimes one cell only between the joints, and sometimes there are three cells, the new interspace originating from what may be called the axis of the polypidom, and which forms the partition between the

cells. The characters, however, which distinguish C. geniculata from C. eburnea appear to be rather those of a variety than of a species; and I have specimens in which the characters of both species seem to co-exist.

The polypes have eight tentacula, which, according to Milne-Edwards, is the number throughout this family.

7. Crisidia,* M. Edwards.

Character.—*Cells linked in a single series; the upper portion free and divergent.* Fig. 63.

1. C. cornuta, *cells tubulous, curved, the apertures all turned in one direction, with a long bristle above each cell.* Ellis.

Plate L. Fig. 1, 2.

Goat's-horn Coralline, *Ellis* Corall. 42, no. 10, pl. 21, fig. *c*, *C.* — *Couch* Zooph. Cornw. 39.—Sertularia cornuta, *Lin.* Syst. 1316 (edit. x. 810). *Berk.* Syn. i. 220. *Esper* Pflanz. Sert. tab. 19, fig. 1-3.—Cellularia falcata, *Pall.* Elench. 76. —C. cornuta, *Hogg's* Stock, 35.—Cellaria cornuta, *Ellis* and *Soland.* Zooph. 25. *Lam.* Anim. s. Vert. ii. 139: 2de edit. ii. 187.—Eucratea cornuta, *Lamour.* Cor. Flex. 149. *Risso* L'Europ. Mérid. v. 319. *Flem.* Brit. Anim. 541. *Templeton* in Mag. Nat. Hist. ix. 469.—Unicellaria cornuta, *Blainv.* Actinol. 462.—Crisidie cornée, *M. Edwards* in Ann. des Sc. Nat. n. s. ix. 240, pl. 8, fig. 2.—Crisia cornuta, *Johns.* Brit. Zooph. 260. *Hassall* in Ann. and Mag. Nat. Hist. vi. 170. *Couch* Corn. Faun. iii. 97, pl. 17, fig. 4; and in the Zoologist, ii. 1095.

Hab. Parasitical on other corallines, and "adhering to Fuci beyond low water-mark, not common," *Fleming.* It is, however, very generally distributed on our coasts; and in many parts occurs plentifully.

Polypidom sometimes half an inch in height, very slender, erect, confervoid, white and brittle when dry, rooted by a few tubular fibres, alternately branched, the secondary branches unilateral or secund. The coralline consists of a series of cells placed one above another, the upper cell originating from the one below near the middle, at its point of divarication from the straight line; and a long tubular spine, which overtops the cell, rises from the same place. The cells are curved, tubular, the upper half everted, with a plain circular patulous aperture. In some specimens oval-shaped vesicles are found scattered over the polypidom: they originate from the base of a cell, are specked, and have a small tube at

* Formed from *Crisia*, and very faulty, because it cannot be used in the plural, that being a family designation.

the back. With a good magnifier the walls of the cells are seen to be specked with a few granules or disks. The long bristles are sometimes jointed.

2. C. SETACEA, "*cells long, tubulous, with curved terminations turned alternately in opposite directions ; a long bristle below the aperture of each cell.*" R. Q. Couch.

Crisia setacea, *Couch* in Zoologist, ii. 1096 ; and in Corn. Faun. iii. 98, pl. 17, fig. sin. under the Crisia cornuta.

Hab. Shores of Devon and Cornwall, *Couch.*

"This is also a calcareous and confervoid species, but is more slender and grows to a greater height than the last, though I have found them much alike in these particulars. It is sparingly and dichotomously branched. Compared with the last species, it presents a well-marked contrast in having the bent necks of the cells turned in opposite directions, and the bristle is situated *below* instead of above the orifice. From the aperture of the cells being turned in opposite directions, the cells themselves might be said to be arranged in a biserial manner. This cannot, however, be considered as strictly the case, since they are inserted into each other at their terminations, and not by their sides." *R. Q. Couch.*

II. CELLEPORINA.

FAMILY—EUCRATIADÆ.

CHARACTER.—*Polypidoms calcareous, confervoid, multiform, the cells elongate, enlarged upwards or clavate, with an oblique subterminal aperture the rim of which is always plain : no external ovarian capsules.*

8. EUCRATEA,* Lamouroux.

CHARACTER.—*Polypidom confervoid, jointed, subcalcareous, the branches consisting of a single row of bent cells, the orifices of which are on one aspect, oblique, subterminal or rather lateral.*

1. E. CHELATA, *cells in the form of a horn ; the aperture oblique, marginated, with a spinous process beneath the rim.* Ellis.

* From *Eucrăte*, one of the Nereids, mentioned by Hesiod, Theogony, v. 243.

Bull's-horn Coralline, *Ellis* Corall. 42, no. 9, pl. 22, fig. *b*, *B*.—Sertularia chelata, *Lin.* Syst. edit. x. 816.—Cellularia chelata, *Pall.* Elench. 77.—Sertularia loricata, *Lin.* Syst. 1316. *Berk.* Syn. i. 220. *Esper* Pflanz. Sert. tab. 29, fig. 1, 2. *Turt.* Gmel. iv. 686. *Turt.* Brit. Faun. 217. *Stew.* Elem. ii. 449.—Cellaria chelata, *Ellis* and *Soland.* Zooph. 25. *Bosc* Vers iii. 134. *Lam.* Anim. s. Vert. ii. 140 : 2de édit. ii. 189.—Eucratea chelata, *Lamour.* Corall. 64, pl. 3, fig. 5. Expos. Method. 8, pl. 65, fig. 10.—Eucratea loricata, *Flem.* Brit. Anim. 541.—Eucratée cornée, *M. Edwards* in Ann. des Sc. Nat. n. s. ix. 204, pl. 8, fig. 1.—Unicellaria chelata, *Blainv.* Actinol. 461, pl. 77, fig. 2.—Crisia chelata. *Johns.* Brit. Zooph. 261. *Reid* in Ann. and Mag. N. Hist. xvi. 392. *Couch* Corn. Faun. iii. 98, pl. 18, fig. 1.

Fig. 64.

Hab. Parasitical on Fuci, crabs, and stones. At Brighton and Hastings, but very rare, *W. W. Saunders.* On stones at very low tides, very rare at Scarborough, *Mr. Bean.* Cork Harbour, *J. V. Thompson.* Frequent on the coast of Ayrshire, *Rev. D. Landsborough.* Found on all sides of Ireland, parasitic on various zoophytes, *W. Thompson.*

"This beautiful coralline is one of the smallest we meet with. It rises from *tubuli*, growing upon Fucus's; and passes from thence into sickle-shaped branches, consisting of single rows of cells, looking, when magnified, like bull's horns inverted, each one arising out of the top of the other. The upper branches take their rise from the fore part of the entrance of a cell, where we may observe a stiff short hair, which seems to be the beginning of a branch. The opening of each cell, which is in the front of its upper part, is surrounded by a thin circular rim; and the substance of the cells appears to consist of a fine transparent shell, or coral-like substance," *Ellis.*—It is impossible to improve this description. I have only to add that there are no granules in the walls of the cells, as in Crisiæ.

The polype "protrudes itself through a small opening at the upper margin of the cell, and the large opening seen in the dead specimen on the anterior surface of the cell, is in the living specimen covered in by a membrane. The polype has from ten to twelve ciliated tentacula about half the length of the cell." *J. Reid.*

9. Anguinaria,* Lamarck.

Character.—*Polype cells spathulate, erect, scattered, with a lateral aperture near the apex, originating from a creeping fistular subcalcareous fibre adnate to a foreign base.—Polypes ascidian.*

1. A. spatulata. Ellis.

Plate L. Fig. 7, 8.

Snake Coralline, *Ellis* Corall. 43, no. 11, pl. 22, fig. *c*, *C. D.*—Sertularia anguina, *Lin.* Syst. edit. x. 816. *Lin.* Syst. 1317. *Turt.* Gmel. iv. 686. *Berk.* Syn i. 220. *Turt.* Brit. Faun. 217. *Stew.* Elem. ii. 449. *Esper* Pflanz. Sert. tab. 16, fig. 1, 2. *Oliv.* Zool. Adriat. 291.—Cellularia anguina, *Pall.* Elench. 78. *Ellis* in Phil. Trans. lvii. 437, pl. 19, fig. 10. *Hogg's* Stock. 35.—Cellaria anguina, *Ellis* and *Soland.* Zooph. 26. *Bosc* Vers iii. 135.—Anguinaria spatulata, *Lam.* Anim. s. Vert. ii. 143 : 2de édit. ii. 196. *Stark* Elem. ii. 439. *Thompson* in Ann. Nat. Hist. v. 252. *Couch* Zooph. Cornw. 44: Corn. Faun. iii. 103, pl. 19, fig. 2.—Aetea anguina, *Lamour.* Corall. 65, pl. 3, fig. 6. Expos. Method. 9, tab. 65, fig. 15.—Sertularia mollis, *D. Chiaie* Anim. s. Vert. Nap. iv. 147.—Anguinaria anguina, *Flem.* Brit. Anim. 542. *Lister* in Phil. Trans. an. 1834, 385, pl. 12, fig. 4. *Blainv.* Actinolog. 467, pl. 79, fig. 3.

Hab. Parasitical on the smaller sea-weeds, not common. "Invests those algæ chiefly whose stems are clothed with hair-like fibres, as Dasya coccinea, Griffithsia equisetifolia, and Sphacellaria scoparia; but found occasionally on smooth stemmed species, as Plocamium coccineum," *W. Thompson.*

This remarkable coralline creeps along the stalks of the sea-weed it prefers in a wavy line, the capillary tube swelling out at irregular intervals, and sending up numerous clavate processes or cells, which are from one to two lines high, more or less bent at the top, of a pale-pink or flesh-colour, or white, smooth, glossy, calcareous; the aperture inferior, subterminal, oval, with plain margins.

Lamouroux suspected that this might prove different from any polypous production, and he felt inclined to class it near to or with

* From *anguis*, a snake,—to the head of which the cells of the Anguinaria have some resemblance.

the Vorticellæ; but the conjecture has been shewn to be groundless by Mr. Lister's discovery of its polypes, which are truly ascidian, and nearly allied to those of the Flustra.

10. Hippothoa,* Lamouroux.

Character.—*Polypidom confervoid, adherent and creeping, calcareous, irregularly branched, the branches frequently anastomosing, formed of elliptical cells linked to each other at the extremities; aperture lateral, near the distal end.—Polypes ascidian.*

1. H. catenularia, *cells contiguous, ovate, thick, with a large oblique oval aperture.* Prof. Jameson.

Plate L. Fig. 9, 10.

Tubipora catenularia, *Jameson* in Wern. Mem. i. 561.—Tubipora catenulata, *Stew.* Elem. ii. 425.—Hippothoa catenularia, *Flem.* Brit. Anim. 534. *Hassall* in Ann. and Mag. Nat. Hist. vi. 170. *Couch* Zooph. Cornw. 43: Corn. Faun. iii. 101, pl. 18, fig. 5.—Hippothoa Elliotæ, *Gray* Zool. Misc. 34.

Hab. On shells, especially bivalves, in deep water, not uncommon.

Polypidom closely adherent, much and irregularly branched in a confervoid manner, white, smooth, glossy, calcareous, the branches spreading, frequently anastomosing, sometimes parallel and coalescing, formed of a series of cells connected like a string of bugles; cells oval, widest and rounded anteally, the aperture oval with a plain thickish rim, placed near the top. In its mode of ramification this coralline resembles many of the plant-like figures in marble or agate. "The branches proceed nearly at right angles, issuing from the margin beside the mouth," and will spread, on a favourable site, to such an extent as will cover an inch or two square surface. When alive it "appears like dew drops, and is easily separated from the shell by a pin; but is strongly attached when dry." *Gray.* In this state the aperture of the cells is sometimes closed by a membrane. The polype remains undescribed.

2. H. divaricata, *cells remote, ovate-lanceolate or fusiform, the aperture small and round.* Miss Elliott.

* A Nereid: *Hesiod.* Theog. 251.

Ἱπποθοη τ' ερόεσσα, και Ἱππονοη ῥοδοπηχυς.

The charming Hippothoa and rosy-armed Hipponoe.

The genus Terebripora of D'Orbigny appears to be synonymous with Hippothoa.

PLATE LI. FIG. 3, 4.

Hippothoa divaricata, *Lamour.* Expos. Method. 82, tab. 80, fig. 15, 16.—Hippothoa lanceolata, *Gray* Zool. Misc. 35. *Hassall* in Ann. and Mag. Nat. Hist. vii. 366, pl. 8, fig. 5, 6. *Couch* Zooph. Cornw. 43. *W. Thompson* in Ann. Nat. Hist. v. 252. *Couch* Corn. Faun. iii. 102, pl. 18, fig. 6.

Hab. On old shells, especially bivalves, from deep water, not uncommon.

"Coral attached, slender, dichotomously and divaricately branched, pearly white; cells slender, linear, ovate, base filiform, generally emitting a cell at right angles from the middle of each side; mouth small, round, with a raised margin, placed near the top of the cell." *J. E. Gray.*

This is much more slender than the preceding species, so that its confervoid polypidom is scarcely visible to the naked eye. The cells are far more distant apart, and are connected by a very delicate calcareous thread: they vary in shape, for on the same specimen I have seen them ovate and bulged at the base, fusiform, elliptical and oblong; and I have also seen a cell fully thrice as large as others near it, and with which it was connected. Hence it seems obvious that the H. lanceolata and divaricata must be united as one species. The aperture, when compared with that of the preceding, is very small, always surrounded by a raised margin, and is sometimes even shortly tubular.

There is a variety of this species in which the cells are contiguous. It is found on sea-weeds only, so far as my experience goes.

3. H. SICA, "*encrusting; calcareous; cells spear-shaped; large end placed distally; apertures small subterminal.*" R. Q. Couch.

Hippothoa sica, *Couch* Corn. Faun. iii. 102, pl. 19, fig. 8.

Hab. "On stones from deep water, common. Polperro, Goran," *R. Q. Couch.*

"This species of Hippothoa differs so decisively from the two described above, that there can be no doubt of its being specifically distinct. The cells are calcareous, enlarged, and rounded at the distal, and pointed at the proximal end. Their direction is linear; they are attached to each other at their extremities, and their length is about four times their transverse diameter. This species is more sparingly branched than the others. The branches arise at

right angles to the cells, from the sides of the apertures. The apertures are rather small, and, as usually seen, are round, even, and unarmed; but, in recent and living specimens, they are long and tubular, frequently as long as the cell. In this state it may be taken for a species of Tubulipora." *R. Q. Couch.*

The fossil *Crisia Johnstoniana* of Dr. Mantell (Medals of Creation, i. 285) belongs to this genus, but it is very distinct from any of the recent species.

11. Gemellaria,* Savigny.

Character.—*Polypidom plant-like, subcalcareous, rather soft and flexible when dry, much branched dichotomously: cells geminate, exactly opposite, united back to back with a thick dissepiment, a joint above and below each pair.—Polypes ascidian, with elongated tentacula: no gizzard.*

1. G. loriculata, *cells inversely conoid and obliquely truncated, the aperture plain.* Doody.

Plate XLVII. Fig. 12, 13.

Muscus coralloides mollis elatior ramosissimus, *Doody* in Raii Syn. i. 34, no. 6.—Coat of mail Coralline, *Ellis* Corall. 40, no. 7, pl. 21, fig. *b*, *B*.—Sertularia loricata, *Lin.* Syst. edit. x, 815.—Cellularia loriculata, *Pall.* Elench. 64. *Hogg's* Stock. 35.—Sertularia loriculata, *Lin.* Syst. 1314. *Turt.* Gmel. iv. 684. *Berk.* Syn. i. 219. *Esper* Pflanz. Sert. tab. 24, fig. 1-3. *Turt.* Brit. Faun. 216. *Jameson* in Wern. Mem. i. 564. *Stew.* Elem. ii, 447.—Cellaria loriculata, *Ellis* and *Soland.* Zooph. 24. *Bosc* Vers. iii. 133. *Lam.* Anim, s. Vert. ii. 136: 2de édit. ii. 179. *Johnston* in Trans. Newc. Soc. ii, 262.—Crisia loriculata, *Lamour.* Corall. 61.—Loricaria europæa, *Lamour.* Expos. Method. 7.—Notamia loriculata, *Flem.* Brit. Anim. 541. *Farre* in Phil. Trans. an. 1837, 413, pl. 27, fig. 6-9. *Hassall* in Ann. and Mag. N. Hist. vi, 170. *Couch* Zooph. Cornw. 42: Corn. Faun. iii. 101, pl. 18, fig. 4.—Loricula loricata, *Templeton* in Mag. Nat. Hist. ix. 469.—Gemicellaria loriculata, *Blainv.* Actinolog. 461, pl. 78, fig. 4.—Gemmellaria loriculata, *Van Beneden* Recherch. 33, pl. 5, fig. 1.

Hab. "A few fathoms beyond low water-mark," common; but Mr. Landsborough has never found "the smallest scrap of it on our western coast."

* Formed from *gemellus*, double, and not from *gemellar*. I learn from the "Nomenclator Zoologicus" that the name was conferred on the genus in 1826; but I had doubts whether the work of Savigny in which it is characterised was ever *published*; nor can I say that my doubts are entirely removed, although aware that copies of it have been placed in public libraries. The genus was subsequently named Loricaria by Lamouroux, Notamia by Fleming, and Gemmicellaria by Blainville.

Polypidom attached by capillary roots, usually from two to four inches long, sometimes even eight or nine, very bushy, "in cupressi formam elongata," greyish-white, flaccid even when dry; the branches close, erect, dichotomous, filiform, consisting of a series of paired cells divided by a simple joint. Cells adnate, smooth, obliquely truncated, placed back to back, "so that the pair together resemble a coat of mail, or pair of stays; and the entrances of the cells look like the places for the arms to come out at." *Ellis.* The polypes have ten tentacula: they have no gizzard, but in other respects the alimentary canal presents the usual details. *Farre.*

I shall find no fitter place than this to introduce a notice of the "Shepherd's purse Coralline" of Ellis,* the position of which amongst zoophytes is still undecided. The species is very rare. Neither Ellis nor Pallas have mentioned any habitat, and no other naturalist named in our synonymy appears to have seen it. I am indebted for my much prized specimens to Mrs. Griffiths. They are parasitical on Plumularia falcata, and are from the shores of Devonshire. Mr. Peach has lately found it in the Isle of Wight.

The description and figures of Ellis possess all their usual beauty and fidelity. He says:—"This most beautiful pearl-coloured Coralline adheres by small tubes to fucus's from whence it changes into flat cells; each single cell like the bracket of a shelf, broad at top, and narrow at bottom: these are placed back to back in pairs, one above another, on an extremely slender tube, that seems to run through the middle of the branches of the whole coralline. The cells are open at top. Some of them have black spots in them: and from the top of many of them, a figure seems to issue out like a short tobacco-pipe; the small end of which seems to be inserted in the tube that passes through the middle of the whole.

"The cells in pairs are thought by some to have the appearance of the small pods of the Shepherd's Purse: by others, the shape of the seed-vessels of the herb Veronica or Speedwell." *Ellis.*

I can add nothing essential to this graphical description. The

* Shepherd's-purse Coralline, *Ellis* Corall. 41, no. 8, pl. 22, fig. *a*, *A*.—Sertularia bursaria, *Lin.* Syst. 1314. *Berk.* Syn. i. 219.—S. Bursa, *Turt.* Brit. Faun. 216. —Cellularia bursaria, *Pall.* Elench. 65. *Ellis* in Phil. Trans. lvii. 437, pl. 19, fig. 12.—Cellaria bursaria, *Ellis* and *Soland.* Zooph. 25. *Lam.* Anim. s. Vert. 2de édit. ii. 189.—Dynamena bursaria, *Lamour.* Corall. 79.—Notamia bursaria, *Flem.* Brit. Anim. 541.—Gemicellaria bursaria, *Blainv.* Actinolog. 461.

zoophyte is the most delicate and the prettiest of its class. (See Plate LI., fig. 1, 2.) It is very thin and apparently calcareous in texture, and resembles Sertularia pumila and rosacea in the manner in which the cells are placed on the rachis, and in the jointed character of the rachis itself. This structure lends support to those who refer the polypidom to Sertularia or Dynamena; and, after an examination of Mrs. Griffiths' specimens I am more favourable to this opinion than formerly. The process "like a short tobacco-pipe" lies over the mouth of the cell, is attached to the rachis by a bulged basis, and the bowl or head of the process, resting on the outer angle of the aperture, is hollow with a slightly sinuated rim. Pallas says that this bowl is the aperture of the cell, in which he appears to be wrong. There is nothing exactly resembling it in any other zoophyte known to me, but I think it may be analogous with a somewhat similar organ in the Laomedea obliqua, or with the "bird's-head" processes in the Cellulariæ. The resemblance, however, is not close enough to indicate any great probability of sameness in their use in the economy of the polype; but they have this in common with the "bird's-head" processes, that they are not found on every cell of the polypidom.

FAMILY—CELLEPORIDÆ.

12. Cellepora,* Otho Fabricius.

Character.—*Polypidom calcareous, cellular, irregularly lobed or ramous, formed of urceolate cells heaped together or arranged in quincunx.—Polypes ascidian.*

1. C. pumicosa, *glomerous, rough, porous; cells suborbicular, the mouth round with a produced marginal process.* Ellis.

Plate LII. Fig. 1, 2, 3.

Porous Eschara *Ellis* Corall. 75, no. 7, pl. 27, fig. *f*, *F*, and 72, pl. 30, fig. *d*, *D*.—Tubipora verrucosa, *Lin.* Syst. edit. 10, 789.—Cellepora pumicosa, *Lin.* Syst. 1286. *Mull.* Zool. Dan. prod. 253. *Berk.* Syn. i. 212. *Stew.* Elem. ii. 428, pl. 12, fig. 16, 17, copied from Ellis. *Lam.* Anim. s. Vert. ii. 170: 2de édit. ii. 256. *Lamour.* Corall. 40. *Flem.* Brit. Anim. 532. *Johnston* in Trans. Newc. Soc. ii. 267. *Templeton* in Mag. Nat. Hist. ix 469. *Couch.* Zooph. Cornw. 48: Corn. Faun. iii. 110, pl. 20, fig. 4, 5.—C. verrucosa, *Lin.* Syst. 1286. *Fabric.* Faun. Grœnl. 434. *Oliv.* Zool. Adriat. 229.—C. spinosa, *Turt.* Brit. Faun. 205.—Millepora pumicosa,

* From *cella* a cell, and πορος.

Pall. Elench. 254. *Ellis* and *Soland.* Zooph. 135. *Jameson* in Wern. Mem. i. 560. *Stew.* Elem. ii. 428.—Flustra bullata? *Ellis* and *Soland.* Zooph. 16. *Stew.* Elem. ii. 436.

Hab.—Found on the stems of various corallines, on stones, and on the roots of Fuci, common.

The cells, by their conglomeration, form a porous friable calcareous mass, encrusting submarine bodies, rarely exceeding an inch in length, usually round when small, more or less oblong and knobbed when large. It is rough, when quite recent of a pinkish colour, dirty-white when dry, rarely tinted with purple. The aperture of the cells is often toothless, but in a perfect condition a short mucro projects from the superior margin, and often a lesser one on each side.—Linnæus' description under C. pumicosa is scarcely applicable, but his quotation of Ellis's figure determines the species he had in view. There can be little doubt that his C. verrucosa—"*cellulis subrotundo-glomeratis ovatis ore subtridentato*" belongs to the same species, as Olivi rightly supposed, although Blainville considers it synonymous with the Discopora verrucosa of Lamarck.

The *Madrepora verrucaria* of Esper's Madrep. tab. 17, fig. c, C, and b, B, is Cellepora pumicosa in an early state.

2. C. ramulosa, *dichotomously branched, the branches cylindrical, rough; cells irregularly clustered, with a mucro on the outer edge of the aperture.* Pallas.

Plate LII. Fig. 4, 5.

Cellepora ramulosa, *Lin.* Syst. 1285. *Mull.* Zool. Dan. prod. 253. *Flem.* Brit. Anim. 532. *Johnston* in Trans. Newc. Soc. ii. 267, pl. 12, fig. 3, 4. *Lam.* Anim. s. Vert. 2de édit. ii. 258. *Thompson* in Ann. and Mag. Nat. Hist. vii, 481. *Hassall* in Ibid. vii, 367. *Couch* Zooph. Cornw. 49: Corn. Faun. iii. 110, pl. 20. fig. 2. *Macgillivray* in Ann. and Mag. N. Hist. ix. 467.

Hab.—In deep water attached to old shells.

Polypidom attached by a spreading base, calcareous, white, light and porous, rising to the height of between two and three inches, branched from the base, the branches bifid, spreading, cylindrical, the ultimate ones a little attenuated at the apex, very rough with the mucronate cells, which are urceolate, without any very regular arrangement, the aperture contracted, the mucro about as long as its diameter.—Pallas (Elench. 255,) and Ellis (Soland. Zooph. 136,) considered this a variety of the proceeding.—The polypes are of a faint red or flesh-colour, with two darker spots indicating the position of the stomach and ovary; tentacula numerous, filiform.

3. C. Skenei, *much compressed, divided in a bifid manner, rough ; cells rowed, with a strong mucro on the outer edge of the round aperture.* Dr. David Skene.*

Plate LII. Fig. 6, 7, 8.

Millepora Skenei, *Ellis* and *Soland.* Zooph. 135. *Turt.* Brit. Faun. 204. *Stew.* Elem. ii. 427.—Cellepora palmata, *Flem.* Brit. Anim. 532.—C. Skenei, *Johnston* in Trans. Newc. Soc. ii. 267. *Couch* Zooph. Cornw. 49 : Corn. Faun. iii. 111. *W. Thompson* in Ann. Nat. Hist. xv, 322.

Hab.—In deep water, attached to shells and corallines. Near Aberdeen, *Skene.* "A single specimen from deep water, Zetland," *Fleming.* Coasts of Northumberland and Berwickshire, not rare. "On stones and the Pinna ingens, off the Deadman, rare," *R. Q. Couch.* Eastern coast of Ireland, *Miss Ball.*

* "Dr. David Skene—after a short time of study at Paris, in addition to the more ordinary preparations—settled as a medical practitioner in Aberdeen, where his father and grandfather had been physicians of reputation: and he soon became eminent in his own profession, as well as in literature and science. To Botany he was particularly devoted ; and he frequently herborized in company with Principal Campbell and Dr. Reid, who were both fully aware of his merits. The former is said to have often lamented that his observations on plants had never been given to the world ; while Dr. Reid, in a letter addressed to him, observes, regarding his extensive acquirements—'But is it all to die with you, and to be buried in your grave ? This, my dear sir, ought not to be. *Stultum est peritura parcere chartæ.* Can you find no time either when you are laid up in the gout, or when the rest of the world is in good health, to bequeath something to posterity ? Think seriously of this.' I find the same distinguished philosopher in another of his letters from Glasgow, urging the physician to present himself as a candidate for one of the medical chairs of that place, about to become vacant by the removal of Dr. Black to Edinburgh, particularly as this might become a step towards the University of Edinburgh, to which Dr. Reid thought his ambition should extend. Nor was this a mere partiality derived from previous personal intimacy ; for more than one seem to have been anxious that the Scottish metropolis should become Dr. D. Skene's place of abode. Thus Lord Kames, a frequent and attached correspondent, says in one of his letters (dated Blair Drummond, 11th January, 1769,) 'I have a most hearty resentment at you for refusing the offer made you by Dr. Hope, which would have settled you in the town of Edinburgh, much to your profit I am certain ; but no particulars till I see you in the Harvest circuit ; ' and in another, 'I wish from my heart to have you settled here, and cannot but regret a good opportunity you missed.' " Dr. Skene was also the correspondent of Pennant, Ellis, Walker, and of Linnæus, several of whose letters to him are still preserved. He died in December 1771, aged 36, leaving behind him numerous manuscripts ; and a museum, consisting of plants, minerals and shells, which might well have been called immense. Taking him all in all he was "probably as extraordinary a man as the north of Scotland ever produced ;" and it is hard to believe that, even in his native city, his name should now be entirely forgotten. See the "Northern Flora," by Alexander Murray, M. D. pref. p. x.

Polypidom attached by a spreading base, calcareous, erect, from half an inch to an inch high, much compressed, divided in a palmate manner, the segments truncate, the surface very rough with the mucronate cells, which are immersed, arranged in regular rows, and have a roundish aperture guarded by a strong divaricate mucro, and in some of the cells there are one or two shorter spines at the base of this. From these spines being worn away the base of the polypidom is generally smooth and more or less rounded : it is sometimes of a yellowish-brown colour, but commonly white, and when dry appears "as if covered over with a silver varnish."

Notwithstanding the apparent dissimilarity in habit of the three preceding Celleporæ, I cannot but suspect that they are merely different states of the same species : for in these productions the "fronti nulla fides" receives many an apposite illustration.

4. C. cervicornis, *much and irregularly branched ; branches compressed, palmate, truncate ; surface roughish or even, compact, with simple circular pores disposed in quincunx.* Borlase.*

Plate LIII.

Porus cervinus, *Borl.* Cornw. 240, tab. 24, fig. 7.—Millepora cervicornis, *Stew.* Elem. ii. 427. *Turt.* Brit. Faun. 204.—M. compressa, *Sowerby* Brit. Misc. 83, pl. 41. *Turt.* Brit. Faun. 204. *Jameson* in Wern. Mem. i. 560.—Cellepora cervicornis, *Flem.* Brit. Anim. 532. *Thompson* in Ann. Nat. Hist. v. 253. *Couch* Zooph. Cornw. 49 : Corn. Faun. iii, 111, pl. 20, fig. 1.

Hab.—"In deep water, not rare," *Fleming.* Cornwall, *Borlase.* Devonshire, *Dr. Coldstream.* Shetland Islands, *Jameson.* Obtained in abundance from the Nymph Bank by *R. Ball, Esq.* Fifeshire coast, rare, *J. Goodsir.* Roundstone Bay ; off the Gobbins, co. Antrim, *W. M'Calla.*

A single specimen of this coral is about three inches in height and somewhat more in breadth. It rises from a broad flattened base, and begins immediately to expand and divide into kneed branches or broad segments, many of which anastomose so as to form arches and imperfect circles. The extreme segments are dilated and variously cut, truncate. Both sides are perforated with numerous

* Borlase, William, of Ludgvan in Cornwall, D. D., born Feb. 2, 1695-6 ; elected F. R. S. in 1750 ; died Aug. 31, 1772 : the author of a History of Cornwall still held in estimation ; and characterized by his contemporaries as an "able and worthy man." See Pennant's Literary Life, p. 1.

pores just visible to the naked eye, and arranged in regular rows : the pores are circular, even with the surface on the smooth and newly formed parts, but on the older they form the apertures of urceolate cells which appear to be formed over the primary layers of cells, and give to the surface a roughish or granular appearance. The orifice is simple, contracted, with a very small denticle on one side. The thickness of the branches varies from a half to two lines ; the interior cellular ; the new parts formed of two layers of horizontal cells, but the older parts are thickened by cells superimposed on the primary layers.

This species certainly treads closely upon the genus Eschara, but Dr. Fleming and Milne-Edwards, who had examined an authentic specimen in the York Museum, both agree in making it a Cellepora. It is entirely distinct from Eschara cervicornis, with which it has been confounded ; but it is nearly allied to, and perhaps identical with, the Millepora alcicornis of Esper, Millep. tab. 5, 6, and 7.—Notwithstanding Mr. Couch's opinion to the contrary, I continue to think that the productions figured by Borlase and myself are the same in species. Mr. Couch has given a good description of it.

5. C. LÆVIS, "*dichotomously branched, cylindrical, the pores wide, with simple mouths.*" Rev. Dr. Fleming.

Cellepora lævis, *Flem.* Brit. Anim. 532. *Couch.* Zooph. Cornw. 50 : Corn. Faun. iii. 112.—Eschara lævis, *Blainv.* Actinol. 428.

Hab.—"A single specimen from deep water, Zetland," *Fleming.* On stones, off the Deadman Point, common," *R. Q. Couch.*

"Height an inch and a quarter, diameter one-tenth ; the branches are smooth, with the orifices of the cells smooth and concave ; towards the extremities the branches are rough with the forming cells, and the orifices are more declining, circumscribed, a little prominent, with a blunt process at the proximal margin." *Fleming.*

"The polypidom is calcareous, from one to two and a half inches high and branched ; the upper portions of the branches roughened by the formation of new cells ; the lower portions smooth and polished. The cells are urceolate ; apertures small with an obtuse tooth at the proximal margin. This species is somewhat similar in appearance to the last, but is whiter, more delicate, and less branched," *R. Q. Couch.*

I am not acquainted with this species. From more than one correspondent I have received specimens for it which were certainly

only C. ramulosa, in which the lower parts of the polypidom had become smoother and more solid than the newer growths, a result of age very usual in the species of this family. The *Cellepora lævis* of Mr. Macgillivray (Ann. and Mag. N. Hist. ix. 467) is evidently this state of C. ramulosa.

6. C. VITRINA, "*encrusting, calcareous; cells ovoid, very small, pearly, and irregularly arranged.*" C. W. Peach.

Cellepora vitrina, *Couch* Corn. Faun. iii. 109, pl. 22, fig. 1.

Hab.—"On stones in moderately deep water, not rare. Goran, *Mr. Peach.* Polperro, Mount's Bay," *Couch.*

"This delicate and beautiful species is very small: it is encrusting, circumscribed, and rarely exceeding a quarter of an inch in diameter. The cells are small, transparent, vitreous or pearly in their appearance, and very irregularly arranged. The apertures are very minute and terminal, and cannot readily be seen even with a lens." *Couch.*

13. LEPRALIA,* Johnston.

CHARACTER.—*Polypidom calcareous or membrano-calcareous, adnate, crustaceous, spreading circularly, formed of a layer of urceolate cells in juxtaposition, horizontal, and arranged in semialternating rows; aperture terminal, often covered with an opercular ovary.*

The Lepraliæ form thin calcareous crusts, of a white, yellow, or reddish colour, on rocks, shells and sea-weeds; and it would appear that they are indifferent to the nature or chemical composition of the basis upon which they develop themselves. They are found in the littoral and laminarian zones, as well as in the regions of corallines and deep sea corals.

* Lepralia—"sea-scurf"—derived frpm λεπρα, leprosy, and ἁλιος, marine: an expressive name for the genus suggested by my friend, the Rev. Thomas Riddell. It is synonymous with the "Berenicea" of Dr. Fleming, but not of Lamouroux, and the name belongs of right to the latter;—the more readily yielded up since we find a "Berenicea" also amongst the Medusæ. Milne-Edwards names the genus "Escharoïdes," but neither this nor Escharina, another of his names, can be adopted, since some naturalists use the terminations *oide* and *ina* as family appellatives. Moreover, what saith Linnæus?—"Generic names including other generic names are unworthy of a scientific nomenclature." And again—"Generic names ending in *oides* are prohibited." See Young's Med. Literature, p. 28.

The crust consists of a congeries of egg-shaped cells laid in a single layer, and disposed in regular rows, yet so that the cells of one row are not exactly opposite to those contiguous to it, but advanced one-half of their length forwards ; or, in other words, the apertures of the first row of cells are not on a line with those of the second but with those of the third row ; and this is the normal arrangement of the cells in all the Polyzoa. It is equally general for the Lepraliæ to spread out into a circle, but the figure is often deranged by accidental causes, and by irregularities in the site.

The polype-cell is shaped like a little barrel, and at its first formation is always distinctly separate from the adjacent ones, but in some species the cells coalesce and become immersed in the common crust, and hence their true form and character can only be ascertained by examining those which occupy the margin of the crust. In other species the aperture, always terminal, is often concealed and distorted by the ovarian capsules, which, like thickly strewed pearls, often roughen the surface of the polypidom. These have been the means of confusing the characters of several species, for sometimes the ovary has been described for the cell itself, and sometimes it has been mistaken for a part of the aperture, which has thus ascribed to it a figure that the ovigerous cell only can ever assume.

* Wall of the cells smooth.

1. L. HYALINA, *cells subcylindrical, the wall thin, transparent and smooth ; the aperture circular, oblique, with an even narrow rim.*

PLATE LIV. FIG. 1.

Cellepora hyalina, *Lin.* Syst. 1286. *Fabric.* Faun. Grœnl. 435, no. 442. *Esper* Cellep. tab. 1. fig. 1, 2. *Lamour.* Corall. 38. *Bosc* Vers. iii. 148.—Berenicea hyalina, *Hassall* in Ann. and Mag. N. Hist. vii. 367.—Lepralia hyalina, *W. Thompson* in Ann. Nat. Hist. v. 253.

Var. β. Wall of the cells thicker, calcareous, and opake. Lepralia cylindrica, *Hassall* in Ann. and Mag. N. Hist. vii. 368, pl. 9, fig. 6.

Var. γ. Cells heaped, usually opake and calcareous. Cellepora ovoidea, *Lamour.* Corall. 38. pl. 1. fig. 1. *Blainv.* Actinolog. 444. *Lam.* Anim. s. Vert. 2de édit. ii. 259. *Lamour.* Expos. Method. 2. tab. 64. fig. 4, 5. *D. Chiaie* Anim. s. Vert. Nap. iii. 38. tab. 34. fig. 33.

Hab.—Parasitical on algæ, shells, stones, and corallines." "Common on marine plants, &c. on the shores of Ireland from north to south," *W. Thompson.* A common species on the Ayrshire coast and partial to the Laminariæ, *Rev. D. Landsborough.* On the same

sea-weeds it is plentiful on the coast of Cornwall, whence I have many specimens from *C. W. Peach.* (γ.) On Sertularia operculata from south coast of Isle of Wight, *W. Thompson.*

Attached to sea-weeds, in small circular or oblong or irregular crusts, by a very thin filmy or calcareous basis in which the cells are partially immersed. Cells radiating in rows, sometimes irregular, semialternate, subcylindrical, or elliptical, raised towards the oral end, smooth and hyaline, marked with one or two slight folds, the walls being almost membranous; the aperture round, entire, somewhat contracted, with a narrow plain rim. In the majority of specimens the central cells are hidden more or less completely with the ovarian capsules, which are comparatively very large, globular, and vitreous, roughened with a few granules, and perforated on the inner or posterior side by a small circular opening. These capsules have been mistaken for cells, and are, in fact, sometimes so numerous as entirely to obliterate or conceal them.

The variety β differs from the normal specimens in nothing except the greater thickness and opacity of the cells. In γ, which is undoubtedly the Cellepora ovoidea of Lamouroux, the cells are not arranged in regular series, but have a tendency to heaping,—hence it occurs in little calcareous clusters of an irregular shape. The specimens which I have from *W. Thompson* are parasitical on Sertularia operculata, and I feel disposed to attribute the conglomeration of the cells to the narrow site hindering the free development of the species. It was first collected by Mr. Thompson, in Belfast Bay, in 1835. "I have since obtained it," he says, "from Strangford Lough and other localities on the Irish coast, around which it is probably found. I have no doubt that it is generally passed over as the young state of some larger species. I find it on algæ as well as on zoophytes."

Linnæus, in his description, has had the ovarian capsules solely in view. The description of Otho Fabricius is, on the contrary, remarkably characteristic, but, regarding the ovaries as cells, he has erroneously adopted the Linnæan specific character: "Cellepora cellulis *subglobosis* diaphanis, ore obliquo simplici."—The description is as follows: "Stratum album diaphanum, verrucosum, polymorphum, jam suborbiculare, jam cylindricum, jam convexum, jamque planum, respectu corporum, quibus adnatum est. Cellulæ confertæ bimorphæ, quæ enim discum occupant cumulatæ, subglobosæ orificio obliquo, medio, laterali, vel etiam terminali infero fere condito, variant; margini autem propriores subcylindricæ, jacentes, ore

angustato terminali limbum quasi radiatum faciunt ; infimis dimidiatis tantum paginam inferiorem strati formantibus. Oscula simplicia, sine dentibus, vixque marginata."

The *Cellepora hyalina* of Cavolini is undoubtedly a different species. Hence it has become impossible to quote with any advantage the works of subsequent systematists, for they have almost invariably copied the character given by Linnæus of the species, and referred us to the figure of Cavolini as its representation ! The *Cellepora hyalina* of Delle Chiaie is likewise a distinct species, nearly allied to our Lep. granifera.

I think it likely that Delle Chiaie's *Cellepora personata* (Anim. s. vert. Nap. iii, 39, tav. 34, fig. 17, 18) is founded entirely on the ovarian capsules of C. hyalina.

The Lep. hyalina, Lieut. Thomas writes me, is common in Orkney, where he meets with two varieties—viz. 1. with the tubes or cells touching, and 2. with the cells separate, and the intermediate space largely punctured. Mr. Peach has sent me specimens of both varieties from Fowey harbour.

2. L. TENUIS, *cells ovate, smooth, with an entire constricted circular aperture, separate or wide apart, and surrounded with a series of large punctures placed in the interspaces.* A. H. Hassall.

PLATE LIV. FIG. 2.

Lepralia tenuis, *Hassall* in Ann. and Mag. N. Hist. vii. 412.—L. vinca, *Couch* Corn. Faun. iii. 116. pl. 22. fig. 7.—L. catenata, *Peach* MSS.

Hab.—On rocks and shells. Dublin Bay, on Laminaria digitata, *A. H. Hassall.* Not uncommon on the coast of Cornwall, from deep water, *C. W. Peach.* On shells of Lima fragilis and Pecten opercularis dredged off Sana Island by Mr. Hyndman, *W. Thompson.*

Polypidom in small thin patches, with an uneven or sinuated outline, closely adherent, and usually of a silvery white colour : cells radiating from the centre, not distinctly rowed, horizontal, small, neat and ovate, separate or apart, the walls of young cells very thin, membranous, pellucid and smooth, the aperture round or with a straight margin on the proximal side : the subcalcareous basis or space between the cells perforated with numerous round or oval holes, forming a sort of chain around each cell. Ovaries rather small, smooth, and glossy, conoidal, projected in front of the cell, and perforated on the apex.

The cells of L. tenuis are many of them nearly parallel, with their apertures on the same line, but the greater number follow the typical semialternating fashion. They are more widely apart than usual, and the interstitial basis is singularly punctured. These punctures are comparatively large, arranged in one series or, in some parts, in two; and they become more numerous and irregular in the space between the termination and origin of the cells. There is frequently a knob or loop in this part. The sides of the walls of the cell are apt to be split into short spines, for this is one of several species that can assume the similitude of Flustra lineata.

In certain circumstances, and from age, the walls of the cells become calcareous, thickened and opaque; and then also we perceive that there is a knob above and behind the upper lip of the aperture. Cells, however, in their perfect state, with their thin, clear parīetes, may generally be detected at the circumference of the crust; and I have not seen a specimen in which the catenated pores were obliterated.

3. L. ASSIMILIS. "*crust transparent; cells rounded superiorly; apertures triangular and mostly furnished with an acuminate operculum. A large and very blunt process is placed beneath each aperture.*" A. H. Hassall.

Hab. "Four specimens are on old valves of Pecten maximus: Dublin Bay," *A. H. Hassall.*

"It is no easy matter at first to distinguish this species from the preceding (*L. tenuis*), from which, however, as well as from *L. hyalina*, I am satisfied that it is distinct." *A. H. Hassall.*—I have seen no specimen of L. assimilis, and in Mr. Hassall's description I cannot find a character by which it can be distinguished from L. tenuis.

4. L. HASSALLII; *cells cylindrical, smooth and opaque, the aperture wide, circular, with a thick rim and a large knob open on each side.* A. H. Hassall.

PLATE LIV. FIG. 3.

Cellepora bimucronata, *Hassall* in Ann. and Mag. Nat. Hist. vii. 367. pl. ix. fig. 1.

Hab.—On shells, rare. On Patella cœrulea, coast of Aryshire, *Rev. D. Landsborough.* Dublin Bay? *A. H. Hassall.*

Crust spreading irregularly, rather thick, but closely adherent,

greyish-white, roughish, composed of cells large enough to be readily distinguished by the naked eye : the cells are horizontal, cylindrical, arranged in rather irregular series, sometimes semialternate, and sometimes opposite and parallel, the walls smooth, thick, dull and opaque; the aperture wide, marginated, subcircular, with a small sinus above, and a large open tubercle or knob on each side looking forwards. Ovarian operculum smooth, situated below the aperture, where it mimics the swollen lobe of the flower of a Calceolaria.

The species is related to the Australasian *Cellepora allata* of Lamouroux; (Expos. Method. 2, tab. 64, fig. 10, 11.) but, in my opinion, has no affinity to the *Cellepora bimucronata* of that author. For this reason I have changed the name to one which may serve to commemorate the researches of a naturalist who has done much to extend our knowledge of this interesting genus.

5. L. SIMPLEX, *cells ovate, ventricose, smooth, the aperture circular, raised, with an even somewhat thickened rim.* G. C. Hyndman.

PLATE LIV. FIG. 4.

Hab.—On various bivalve shells, dredged at Sana Island, July 1841, by *G. C. Hyndman.* Apparently not rare.

Spots irregular, dull greyish-white, formed of a congeries of cells, which are very distinctly defined and isolated, contiguous and arranged in the usual quincunxial fashion, although some of them are oftener out of their ranks than in any other species. Cells ovate, narrowed in front, ventricose, raised or semi-erect, the parietes rather thick and even, neither punctured nor warted; the aperture a plain circular opening, whose rim is a little thickened and frequently everted. There is an obtuse knob behind the margin of the upper lip. In the space between the cells there are, in some specimens, a few irregular punctures.

6. L. VENTRICOSA, *cells distinct, ovato-globose, narrowed in front, roughish; aperture subquadrangular with a mucro on the proximal margin, and four obtuse spines on the sides.* A. H. Hassall.

PLATE LIV. FIG. 5.

Lepralia ventricosa, *Hassall* in Ann. and Mag. N. Hist. vii. 412.

Hab.—" Collected in the bay of Dublin : it is likewise found on the English coast at Burnham, Norfolk," *A. H. Hassall.* Coast of

Cornwall, on old bivalve shells, *C. W. Peach.* On shells dredged off Sana Island, by *G. C. Hyndman.*

Mr. Hassall says that the crust when dry is "brownish and glistening;" but, in the specimens I refer to the species, it is greyish-white, of an irregular shape, composed of cells, which, although contiguous, are distinct and well defined: they are ovato-globose, narrowed anteriorly, with thick, roughish, or subgranular even walls, the aperture subquadrangular, with a prominent mucro in the centre of the proximal margin, and four short and equal spines on the sides and lower margin, which is rounded. Ovaries globular and roughish.

In many specimens there are a series of very distinct punctures in the space between the cells; and in one or two I have found a perforation behind the oral mucro, which was probably the result of accident. In old specimens the spines at the sides of the aperture disappear more or less. The species is allied to Lep. simplex.

7. L. Hyndmanni, *cells subglobular, contracted in front, the aperture plain, rounded, with a deep sinus on the proximal margin; on the side of the cell a large hollow spinigerous process.*

Plate LIV. Fig. 6.

Hab.—On the inner surface of a much decayed valve of Pecten opercularis, and on other bivalve shells, dredged at Sana Island,* July 1841, by *G. C. Hyndman.*

The crust formed by this rare and remarkable species is dull white and undefined; the cells are distinct, but contiguous, of a medium size, subglobular, narrowed and somewhat raised anteriorly, the back smooth and thickish, but the base of the cells, or the space between them, is occasionally perforated with a series of punctures. The aperture has a neat and deep sinus on the proximal side, and the distal margin is plain and rounded. The stout short tubular process, on the posterior side of the cell, is always very obvious, and there issues from it a long slender bristle, which, however, is often broken away; and in a specimen on a Lima I can find no trace of it. Ovarian capsules proportionably small, globular, with a smooth surface.

I have dedicated the species to a naturalist, resident in Belfast, who has contributed some very interesting additions to our Fauna.

* Sana or Sanda Island is off the S.E. of the Mull of Cantire, W. coast of Scotland.

8. L. ANSATA, *cells subglobose, punctulated; the aperture circular, sinuated on the proximal side, even and plain, with a wide open auricle on each side.*

PLATE LIV. FIG. 12.

Hab.—On a slaty rock sent from Cornwall by *C. W. Peach.*

Crust circular, rather thick, roughish, closely adherent, of a dull white colour: cells of medium size, distinct but contiguous, ovato-globose, roughish, very minutely punctured, the aperture circular, with a well defined deep sinus above; and behind it there is a dorsal mucro on most of the cells. On each side of the aperture a hollow auricle projects forwards; and, viewed in front, these auricles have a miniature resemblance to the ears of a fox or cat.

Although the cells are punctulated, I place this rare species next to Lepralia Hyndmanni, of which it may possibly be merely a state or variety. Their separation depends on the presence or absence of the spinigerous tubercle and of the lateral auricles, but the value of these characters is still undetermined; whereas the form of the aperture, and the shape of the cells, which seem to be certain characters, are alike in both species.

9. L. OVALIS, *crust glistening; cells well defined and oval, the aperture circular, oblique, wide, with a mucro on the upper lip, and two spines on the lower margin.* A. H. Hassall.

PLATE LVI. FIG. 1.

Lepralia ovalis, *Hassall* in Ann. and Mag. Nat. Hist. ix. 413.

Hab.—On dead bivalve shells and rocks, rare.

"This is a distinct, and, I imagine, a very rare species, as I have but one Irish specimen attached to a piece of granite, procured at Kingstown. From *L. trispinosa* of Dr. Johnston, a species with which I am not acquainted, it differs in being very rarely provided with three spines, and in the absence of the spout-like excavation represented in the figure of that species; while from *L. immersa* it is at once known by the much larger size of the cells, discernible plainly by the unassisted eye, as well as by other characters less obvious. This is likewise an English species, being found at Burnham, Norfolk."—*A. H. Hassall.*

A beautiful and distinct species, more nearly related to *Lep. pediostoma*, and, especially, to *L. verrucosa*, than to the species mentioned

by Mr. Hassall. The crust is extensive, closely adherent, varnished, whitish or straw-yellow, with unformed cells on the edge; the cells rather large, well-defined, ovato-ventricose, rising anteriorly, with thin semi-vitreous parietes, and the space at the base between the cells somewhat punctured or areolated. The aperture is large, sub-circular, and oblique. In the specimens of Mr. Thompson before me, the mucro on the proximal margin is rather obtuse but not "bifurcate," nor emarginate, as it is represented by Mr. Hassall; and the two or, rarely, three spines on the distal side are perfect only in a very few cells, but vestiges of them are observable on most of them.

10. L. LINEARIS, "*cells much depressed, radiating in lines from a centre, and increasing in size towards the edge of the crust, upper part rounded; aperture contracted, circular, with a minute spout-like elongation below; teeth either three or four, surrounding the upper half of the aperture: on either side of the small spout-like elongation referred to, a short blunt process is visible.*" A. H. Hassall.

PLATE LIV. FIG. 11.

Lepralia linearis, *Hassall* in Ann. and Mag. Nat. Hist. vii. 368. pl. 9. fig. 8.

Hab.—"On stones east of Kingstown harbour, and at the Giant's Causeway: not common," *A. H. Hassall.*

The only specimen I have seen forms a thin, white, sub-circular crust on the inner surface of a valve of Pecten opercularis. It is marked with lines visible to the naked eye, produced by the septa between the rows of cells, the apertures of which are also distinguishable. The cells are horizontal, coalescent, oblong, divided by distinct septa, slightly dilated towards the aperture, which is small, circular, even, with a neat sinus on the proximal margin, and a hollow tubercle on each side projecting like a shoulder. The walls are vitreous and obsoletely granulous. Ovarian capsules small, globose, granulated or punctured, with a large perforation on the posterior side.

The species is nearly allied to Lep. auriculata, and belongs to the same natural section as the Lep. trispinosa, the edge of the crust being unfinished and marked with the divergent lines that mark the boundaries of the nascent cells. My specimen is a good one, yet not a single cell possesses any marginal spines on the aperture; another proof of the imperfect value of them in affording a specific character.

11. L. 4-DENTATA, "*cells immersed, arranged alternately; apertures quadrangular, and furnished with four short teeth placed near each angle.*" A. H. Hassall.

Lepralia 4-dentata, *Hassall* in Ann. and Mag. Nat. Hist. vi. 171. pl. 6. fig. 5. *Macgillivray* in Ibid. ix. 467.

Hab.—It is enumerated as an Irish species by *A. H. Hassall*, and has been found on a dead valve of Cyprina islandica, near Aberdeen, by Mr. J. Macgillivray.

I have seen no authentic specimen of this species. The figure of it, given by Mr. Hassall, would induce us to place it in the genus Membranipora.

* * Wall of the cells granulous.

12. L. GRANIFERA, *cells ovate, granulous, with an obtuse process or knob in front; the aperture entire, semi-lunar, with the upper lip transverse and even.* G. J.

PLATE LIV. FIG. 7.

Hab.—On rocks between tide-marks, rather rare. On slaty rocks in front of the coves of Holy-Island, and in Berwick Bay, *G. J.* Isle of Man, on old bivalved shells, *E. Forbes.* Coast of Ayrshire, *Rev. D. Landsborough.* Coast of Cornwall, *C. W. Peach.*

The crustaceous spots formed by this pretty and well-marked species so much resemble those of *Lep. tenuis* that they can only be distinguished by the different character of the cells. These are arranged in a quincunxial fashion, semi-alternate, horizontal, ovate, narrowest at the distal end, the walls of the exterior or newest series glassy, dotted with numerous small perforated granules, and marked with two or three irregular transverse folds; and there is an obtuse hollow knob above the aperture, a little behind its superior edge. The aperture is encircled by a very narrow rim, entire, constricted, semicircular, the upper side even and straight.

In the old and central cells the walls become thicker and opaque, and the granules are not so easily to be distinguished. There often appears also, on each side of the aperture, a small projecting loop, of the same character as those which occur in *Lep. ansata;* and, in a specimen from the Isle of Man, there are two spines on the inferior oral angles. In this specimen the process above the rim of the cells is perforated or open. The ovaria are globose, opaque, pearly white, and smooth, with a large opening on one side.

13. L. Landsborovii, *cells horizontal, coalescent, ovate, with thin granulous walls, the aperture large, circular, with a deep sinus on the upper margin.* Rev. David Landsborough.

Plate LIV. Fig. 9.

Hab.—On Pecten opercularis from the coast of Ayrshire, *Rev. D. Landsborough.*

Polypidom forming a thin, white, and closely adherent circular crust, of the size of a wafer : the cells rather large, horizontal, contiguous, ovate, semi-alternate, with the walls thin, glassy, and hyaline; thickly dotted with small perforated granules ; the aperture somewhat prominent, oblique, patulous, unarmed, circular, sinuated on the proximal side, and in the centre of this sinus there is usually a small mucro.

I have dedicated this very rare species to my friend the Rev. David Landsborough, for many years minister of the parish of Stevenston, but now the pastor of those of his former flock who are members of the Free Church of Scotland. He published in 1828, "Arran : a Poem, in six cantos." Edin. 1828,—a very pleasing work, in which the biographer might find easily a correct portraiture of the author's mind and tastes. He is the author of one or more other volumes, and of numerous essays in our religious and Natural History periodicals : and in Natural History has made many interesting discoveries, of which this Lepralia is the least. White, of Selborne, has never had a worthier, or more intelligent and more amiable disciple.

14. L. auriculata, *cells coalescent, short, rhomboidal, bounded by a fine and very distinct line ; the aperture small, circular, plain, with an arched sinus on the proximal side.* A. H. Hassall.

Plate LIV. Fig. 8.

Lepralia auriculata, *Hassall* in Ann. and Mag. N. Hist. ix. 412.

Hab.—On shells. Trawled up off Bray. Found on oyster-shells from Burnham, Norfolk, *A. H. Hassall.* On a valve of Pecten maximus, dredged off Scilly by *Mr. MacAndrew.*

Crust white, closely adherent, spreading circularly, with an unfinished lined margin : cells semi-alternate, conjunct, horizontal, swollen a little in the middle, short and quadrangular, or rather rhomboid, well defined by the septa, which form a distinct boundary ;

the walls thin and granulous ; the aperture small, circular, with an arched sinus on the upper lip. Ovarian capsules globose, roughish, with a large round opening on the posterior side.

Mr. Hassall says that the "crust is generally reddish, even when dried," but the few specimens I have seen are either white or cream-coloured. He also introduces into the specific character "two slender divergent teeth" on the aperture; but afterwards it is said that these are "seldom present." I find the aperture almost always unarmed; yet in a very few cells of one specimen there are two short spines on the lower lip ; and in one cell there are three spines. The species is allied to L. trispinosa, but very distinct. The cells are sometimes almost ovate, with the septa less obvious than in typical specimens.

* * * Wall of the cells punctured.

15. L. PERTUSA, *cells ovato-ventricose, punctured, distinct, with a somewhat contracted circular aperture, the margin of which is plain and even.* W. Thompson.

PLATE LIV. FIG. 10.

Cellepora pertusa, *Esper* Pflanz. Cellep. p. 149. tab. x. fig. 2.—Escharina pertusa, *M. Edwards* in Lam. Anim. s. vert. 2de édit. ii. 232.—Cellepora perlacea, *W. Thompson* in Ann. and Mag. N. Hist. x. 20.—Escharina perlacea, *M. Edwards* in Lam. Anim. s. vert. 2de édit. ii. 234,

Hab.—On rocks and old shells, not common. On a species of Lima from the Isle of Man, *E. Forbes.* Coast of Cornwall, *C. W. Peach.* On Limæ dredged off Sana Island by *G. C. Hyndman.*

Cells forming a brown, or cream-coloured, or whitish crust, arranged as usual, ovato-ventricose, often with a glistening lustre, the walls thickly and irregularly punctured, opaque. They are nearly the size of those of Lep. unicornis, but more ovate and ventricose. The aperture is perfectly circular and even. The ovarian capsules are large, globular, and punctured like the cells.

The crust is thickish, and spreads occasionally to a considerable extent, the outline being uneven. The cells are about the largest of any species in the genus, and fully one-third larger than those of L. punctata or L. annulata.

In small and very perfect specimens the wall of the cells, instead of being punctured, appears to be granulated, and the little granules are each of them surrounded by a paler halo. On such a specimen is founded the Cellepora perlacea of Della Chiaje.

16. L. PUNCTATA, *cells subcylindrical, foraminous, the punctures obscurely rowed transversely, the aperture roundish, uneven, with 3 or 4 obsolete denticles on the rim.* W. Bean.

PLATE LV. FIG. 1.

Lepralia arenacea, *Bean* MS.—Lepralia punctata! *Hassall* in Ann. and Mag. Nat. Hist. vii. 368. pl. 9. fig. 7.—Lep. pedilostoma, *Couch* Corn. Faun. iii, 113. pl. 22. fig. 14.

Hab.—On rocks, and sometimes on old shells, between tide marks; not uncommon.

Crust thin, greyish or, when young, silvery-white, entirely adherent, with an uneven outline, and formed by the aggregation of the cells, which are arranged in regular series. They are semi-alternate, contiguous, and horizontal; the walls thin and perforated with numerous rather large punctures arranged across the back, the aperture roundish, with a rim rendered uneven by three or four short denticles: one of these projects from the centre of the upper lip, while the others are from the sides or lower margin. In most specimens there is a triangulate divergent slit or loop on each side of the aperture; and under the inferior lip we see occasionally a small calceoform tubercle. The lateral apertures appear occasionally in almost every species; and the labial tubercles are ovaria in an embryo condition.

This pretty species is nearly allied to the Lepralia annulata, and to the Cellepora pertusa of Esper, but distinct from both of them. In consequence of some discrepancy in our descriptions and figures, it is necessary to mention that Mr. Hassall furnished me with a specimen of his Lepralia punctata, which is represented with from two to four spines on the lower lip of the aperture. Neither Mr. Bean nor Mr. Peach have ever noticed these spines.

When, from friction or any other cause, the upper wall of the cells is removed, the remainder of this polypidom exactly resembles a crustaceous Flustra with oval cells, bounded by septa, which are bored all round with a series of small punctures. Some of the fossil Fenestellæ appear to be species of Lepralia in this flustroid state.

17. L. ANNULATA, *cells urceolate, punctured, the punctures in transverse rows; the aperture transverse, somewhat bilabiate, plain or armed with two spines below shorter than the diameter of the cell.* D. Landsborough.

Plate LV. Fig. 2, 3.

Cellepora annulata, *Fabr.* Faun. Groenl. 436. no. 444. *Turt.* Gmel. iv. 641.—Cellepora bimucronata, *Lamour.* Corall. 41. *Lam.* Anim. s. vert. 2de édit. ii. 260.

Hab.—On the fronds of Laminariæ, common on the Ayrshire coast, *Rev. D. Landsborough.* On shells of Limæ dredged off Sana Island, by *G. C. Hyndman.*

Polypidom forming a small round or irregular calcareous crust, entirely adnate, and of a clear or dusky white colour, according to its age or state of preservation: cells not regularly serial, semi-alternate, horizontal, contiguous, urceolate, the walls thickish and punctured with holes situated in obscurely marked depressions which cross the cell, and have given origin to its specific denomination; and there is a medial line down the cell apparent in good specimens. The aperture is surrounded with a smooth rim, transverse, somewhat bilabiate, the lips projecting a little in the centre; and on the central cells there are two obtuse spines, one on each side of the inferior angles of the aperture, and shorter than its diameter. Ovaries globular, rather small.

The cells are about the size of those of Lep. unicornis, but rather broader in proportion to their length. The marginal, or new, cells have seldom any spines, while the inner ones are almost as constantly armed with them. It would appear, therefore, that their formation is subsequent to that of the cell, and their presence not specifical.

I entertain no doubt of this being the Cellepora annulata of the most worthy author of the "Fauna Groenlandica." It were indeed easy to point out discrepancies between his description and mine which might determine others to a contrary conclusion; but the endeavour to ascertain the species of the older authors will ever be vain if we go to the work with an adverse or an unwilling mind. The better way, surely, is to estimate fairly how far the differences we may perceive may be accidental and peculiar to individual specimens; and to infer a probable identity where the essential and permanent characters are the same, or nearly so. Thus, in the example before us, I find the proof of the sameness of our species in Fabricius' admirable description of the aperture of the cell, and of its punctured walls,—so exact that it matters not that I have not found the cells separate or solitary, as he appears mostly to have done.* The description of the aperture is as follows: "Osculum terminale marginatum,

* Since this was written I have found the cells solitary in several instances; and in other examples there were only from three to five cells.

ringens, acumine medio supra infraque prominet, et denticulis duo longioribus inferis erectiusculis instructum, hinc quasi quadridentatum."

18. L. FIGULARIS, *cells distinct, the back crossed with* 4 *or* 5 *lines of punctures, and encircled with a series of marginal stomata ; aperture subquadrangular, unarmed.* C. W. Peach.

PLATE LVI. FIG. 2.

Hab.—On a much decayed bivalved shell, sent from Cornwall by *C. W. Peach.*

Crust irregularly defined, rather thick, dull and opaque, chalky-white, composed of rows of semi-alternating horizontal cells distinguishable by the naked eye : cells a little separated from each other, barrel-shaped, horizontal, flattened on the upper side, which is crossed with five or six impressed and slightly curved series of minute punctures, while a row of large mammillated punctures are set round the sides. There are about twelve of these, which may be compared to the spiracles of insects, or the stommata of the leaves of plants; and I have not observed them in any other species. Down the centre of the back of the cell there is usually a more or less evident keel. Aperture subquadrangular, with a smooth slightly thickened margin, and partially closed with a membranous tonguelet ; the remains of the polype's operculum. Ovarian capsules large, shaped like the inferior lobe of the Calceolaria, and marked with a lunate impressed spot on each side in front.

Allied to Lep. annulata, but the cells are larger, and the pattern on which they are moulded is much more beautiful.

19. L. BIFORIS, *cells sub-globular, distinct, punctured on the sides and forwards, with a lunate hole in the back ; aperture subquadrangular or lunate, the upper lip straight and transverse, the lower rounded.* W. Thompson.

PLATE LV. FIG. 4.

Cellepora Macry, *W. Thompson* in Ann. and Mag. N. Hist. x. 20.

Hab. Parasitical on the tunic of an Ascidia from Strangford Lough, 1839 ; and on old bivalved shells from Portaferry, *W. Thompson.* On Pecten maximus, dredged between Larne and Glenarm, co. Antrim, *R. Patterson.* It is not a rare species. I have specimens on sea-weed, and a beautiful specimen on the bark of a tree sent me from Ayrshire by the *Rev. D. Landsborough.*

Polypidom in the form of a white, roughish calcareous crust having a tendency to spread circularly, formed as usual of an aggregation of horizontal cells, arranged in quincunx, distinct and ventricose, ovato-globose, slightly bulged at the middle, the walls either vitreous or opaque, punctured round the sides and near the oral extremity, leaving the central part smooth, where there is a very distinct lunate hole with a raised margin : aperture of the cell subquadrangular, straight and even on the upper margin, the lower rounded, either smooth or with a spine on each side not longer than its own diameter ; but these spines form no essential character, for specimens of the polypidom occur in which not a single cell possesses them. I have other specimens from Mr. Peach with three divergent spines on the lower lip. Ovarian capsules globular, pearly-white, smooth.

20. L. Peachii, *cells crowded, globose, distinct, perforated with oblong punctures, principally around the base ; aperture sub-quadrangular with a mucro on the proximal lip, and several short denticles on the distal margin.* C. W. Peach.

Plate LV. Fig. 5, 6.

Hab. Not uncommon from deep water on stones and shells, *C. W. Peach.* On Limæ dredged off Sana Island by *G. C. Hyndman.*

Forms a calcareous spot without any definite outline, closely adherent : cells crowded, rather small, distinct, but contiguous, globose, the walls opaque, perforated with numerous oblong punctures arranged in a sort of circle round the base, smooth towards the aperture. In the great majority of the cells the spines of the lower lip are broken off, so that a series of punctures there is all that can be seen, but in other cells the short spines are very apparent. They appear to be five or six in number. In a specimen on the external surface of a shell I find the lip perfectly smooth, the development of the spines probably having been hindered by its exposed situation. But it is to be remarked that the absence or presence of spines is not absolutely specifical in this genus.

21. L. pediostoma, *cells barrel-shaped, the walls coarsely punctured all over ; the aperture raised, gaping, oblique, calceoliform, with a plain rim.* A. H. Hassall.

Plate LV. Fig. 7.

Flustra hibernica, *Hassall* in Ann. and Mag. Nat. Hist. vi. 172. pl. 7. fig. 1 ; and vii, 370. The figure quoted " represents a posterior view of the cells, the wall of

each cell posteriorly being absent."—Lepralia pedilostoma, *Hassall* in Ann. and Mag. Nat. Hist. vii. 368, pl. 9, fig. 4.—Flustra Peachii, *Couch*, "9th Report of the Cornwall Polytechnic Society, p. 81."—Membranipora Peachii, *Couch* Corn. Faun. iii. 120. pl. 22. fig. 13.

Hab. On rocks and shells near and within low-water mark. "Blackrock and Portmarnock (Dublin Bay) not uncommon. I have also found specimens of this species adhering to the bottom of an old hulk, the Olbers, in Plymouth sound," *A. H. Hassall.* Very plentiful on the Cornish coast, *C. W. Peach.* Coast of Ayrshire, *Rev. D. Landsborough.* Berwick Bay, very rare, *G. J.*

Crust spreading circularly, and forming considerable patches, thickish and calcareous, of a light crimson-red, or sometimes of a pure white colour, often with a glassy lustre: cells rather large, shortly ovate, ventricose, arranged semi-alternately in regular rows, contiguous and sometimes almost imbricate, oblique or rising towards the aperture, which is wide and patulous, oval, with a slight contraction on each side, giving it a remote resemblance to the sole of a shoe, the rim smooth, plain, and slightly everted. The walls of the cells are either foraminous or merely reticulated with lighter and more opaque spots, an appearance which proceeds from the punctures being occupied with a thin membrane.

Specimens, furnished with profuse liberality by Mr. Peach, have led me to the conclusion that Flustra Peachii is a mere state of this very fine species, produced by the obliteration of the superior wall of the cells. In this guise it appears like a gauze-work expansion spread over the surface of shells and stones, of a membranous texture, with oval cells, bounded by a rather thick and plain border, and at each extremity with one or two minute raised circular punctures. The cells are often rendered unequal, and somewhat deformed by crowding and pressure.

22. L. VERRUCOSA, *cells oblique, areolated around the base, smooth in front; aperture gaping, semicircular, with a plain rim jutted upon by a strong mucro.* W. Bean.

PLATE LVI. FIG. 3.

Cellepora verrucosa, *Esper* Cellep. tab. 2. fig. 1, 2.—Lepralia Johnstoni, *Bean* MSS. —Lepralia verrucosa, *W. Thompson* in Ann. Nat. Hist. xiii. 440.—Lepralia reticulata, *Couch* Corn. Faun. iii. 117. pl. 22. fig. 9.

Hab. On rocks and bivalve shells, not common. Near Scarborough, very rare, *W. Bean.* Dublin Bay, *Miss Ball.* Coast of

Cornwall, *C. W. Peach*, who says that it is found near low-water mark, and also in deep water.

The crust of L. verrucosa resembles that of L. pediostoma in thickness and colour, and the cells in both are also nearly equal in size : but those of L. verrucosa are more raised in front, their walls are of a thinner texture, and consequently more friable, and, instead of being punctured, the anterior and upper part is smooth, while the base is very prettily areolated. In some specimens the cells are ribbed longitudinally, the ribs diverging from the summit, but these are easily recognised. The main distinction between L. pediostoma and verrucosa, however, is found in the different shapes and character of the apertures, as given in their respective specific characters.

Notwithstanding his quotation of Esper's figure, Lamarck's Discopora verrucosa has no relationship to this production.

23. L. RETICULATA, *cells oval, horizontal, punctured in the septa, the aperture plain, rounded, with a sinus on the proximal side, and a triangular hole behind it.* J. Macgillivray.

PLATE LV. FIG. 10.

Lepralia reticulata, *J. Macgillivray* in Ann. and Mag. Nat. Hist. ix. 467.

Hab. On bivalve shells from deep water, rare.

Crust chalk-white, undefined, punctured, obscurely lineated ; cells horizontal, arranged as usual, ovate, depressed, the walls opaque, roughish, the interspaces coarsely punctured. On a few of the cells there are traces of three spines on the margin of the aperture. Nearly allied to Lep. variolosa, but differs in the more defined limits and shape of the cells, and in the character of their aperture.

24. L. VARIOLOSA, *cells oblong, depressed, roughish, punctured in the interstices ; the aperture semi-oval or roundish, with a plain margin.*

PLATE LV. FIG. 8, 9.

Var. *α*. Lip sinuated on the proximal margin. Fig. 8.
Var. *β*. Lip with a denticle on the proximal margin. Fig. 9.
Lepralia variolosa, *Johns.* Brit. Zooph. 278. pl. 34. fig. 4. *Hassall* in Ann. and Mag. Nat. Hist. vii, 367. *Couch* Zooph. Cornw. 50. Corn Faun. iii. 116. plate 22. fig. 6. *W. Thompson* in Ann. Nat. Hist. v. 253.

Hab. On stones and bivalved shells, common.

Crust spreading, closely adherent, even, often roughened in the centre, yellowish or dull greyish white, the space between the cells

coarsely punctured like the end of a thimble : cells sub-contiguous, arranged in regular semi-alternating rows, slightly raised anteriorly, the aperture roundish or semi-oval, entire, either sinuated or armed with a small tooth on the upper edge : ovarian capsules globular, smooth, and pearly.

When dried the crust can in some instances be separated from its foreign base in small pieces, but in general it is very firmly adherent, and has a decided tendency to grow in a circular form. The patches are often upwards of an inch in diameter. The central cells are so deeply immersed in the crust that their form is rendered indistinct, and even the intersticial punctures will disappear ; but the marginal cells in general exhibit the character of the species sufficiently. In a good specimen in my possession, many of the cells are characteristic, but many others are punctured all over ; the interstitial spaces between some are smooth, between others punctured, and between others again they are raised into elevated lines or septa. I fear that a tact, to be acquired only by some experience in their examination, is often necessary for the discrimination of Lepraliæ.

"Lepralia variolosa is rather plentiful, and Proteus-like. I have seen it with *two spines* on the distal edge of the aperture ; they run side by side at first, and then turn upwards." *C. W. Peach.*

25. L. FENESTRALIS, "*encrusting, calcareous ; cells urceolate, slightly immersed, semi-erect, and reticulated ; aperture contracted, circular, with a slight tooth on the proximal lip.*" R. Q. Couch.

Lepralia fenestralis, *Couch* Corn. Faun. iii. 117. pl. 22. fig. 8.

Hab. "On stones at short distances from the shore, not uncommon," *R. Q. Couch.*

"This rarely exceeds three-fourths of an inch in diameter ; it is calcareous and encrusting. The cells are urceolate, and closely arranged in circular rows ; they do not, like most other species, lie horizontal to the crust, but the oral portions are elevated, or semi-erect. The surface of the cells is rough ; several calcareous lines run longitudinally their whole length, and these are crossed nearly at right angles by shorter bands, which give the surface a net-work appearance with square meshes. This window-like surface has the interspaces filled with a transparent membrane, which is more apparent in dried than in living specimens. The aperture is small, contracted, and circular, with an irregularity on the proximal lip." *R. Q. Couch.*

* * * * Wall of the cell fissured.

26. L. NITIDA, *cells subcylindrical, glassy, crossed with about six fissures interrupted by the smooth medial line ; aperture wide, terminal, subquadrangular.* Dr. Fleming.

PLATE LV. FIG. 11.

Cellepora nitida, *Fabr.* Faun. Groenl. 435. no. 443. *Lam.* Anim. s. vert. 2de édit. ii. 259.—Berenicea nitida, *Flem.* Brit. Anim. 533,—Lepralia nitida, *Johns.* Brit. Zooph. 277. pl. 34. fig. 7. *Hassall* in Ann. and Mag. N. Hist. vii. 367. *W. Thompson* in Ann. Nat. Hist. v. 253. *Couch* Corn. Faun. iii. 114. pl. 22. fig. 3.

Hab. On rocks, shells, and Laminariæ. On shells, rare, *Dr. Fleming.* Isle of Man, *E. Forbes.* Scarborough, on Anomia ephippium, very rare, *W. Bean.* In Berwick Bay, on Patella cœrulea, *G. J.* Coast of Ayrshire, *Rev. D. Landsborough.* Coast of Cornwall, *C. W. Peach.* Strangford Lough, *W. Thompson.*

Crust closely adherent, spreading irregularly, greyish-white, calcareous : cells contiguous, rowed, horizontal, semi-alternate, sub-cylindrical, silvery and glistening, the walls fissured with six or seven cross slits which meet on the mesial line ; aperture terminal, wide, subquadrangular, unarmed, but sometimes there is a short spine on each side of its lower angle. Over the aperture there is often found a pearly ovarian capsule, which is globular and smooth, and has a small round opening on one side.

The remarkable structure of the cells renders this one of the most interesting species under the microscope. I would say of it what Fabricius says of his Cellepora annulata,...“pulcherrima et perfectissima hæc omnium visorum.” Mr. Hassall compares the cell to “a miniature human thorax ; the cross pieces representing the ribs, and the broad band into which these are inserted being analogous to a sternum. A distinct spine is frequently to be observed on each side of the lower angle of the mouth of the cell.” Mr. Peach has found it with four or more spines at the aperture ; and I have specimens confirmatory of the observation.

A specimen on the shell of a Mytilus from Kirkwall Bay, presented to me by Lieut. Thomas, R.N., is branched in a fine dendritic manner, like Alecto dilatans.

27. L. INNOMINATA, *cells short, sub-orbicular or ovate, furrowed, the ribs radiating from the dorsal line ; aperture small, circular, armed with several short denticles or spines not longer than its diameter.* C. W. Peach.

Plate LV. Fig. 12.

Lepralia innominata, *Couch* Corn. Faun. iii. 114. pl. 22. fig. 4. (very bad.)—Lep. pectinata, *Peach* MS.

Hab. On stones and shells from deep water. Coast of Cornwall, *C. W. Peach.* On bivalves dredged off Sana Island by *G. C. Hyndman.*

Polypidom forming a white, closely adherent, leprous crust on the surface of the stone: cells calcareous, approximate, distinct, subalternate, horizontal, shortly ovate, or sometimes almost orbicular, and very like the shell of a Pecten in miniature, grooved with ribs which radiate from the centre of the back to the edge; aperture small, round, armed with several short obtuse teeth or spines.

The ribs or furrows of the cells appear to diverge sometimes from a central umbo, and sometimes from the medial line, and in the former case their likeness to the shell of the Pecten is very striking. These cells resemble also the ovarian capsules of some species of Lepralia. The spines of the aperture are frequently destroyed.

28. L. semilunaris, "*crust when dry opake white; form of cells not very distinct; walls usually perforated; apertures semilunar, mostly furnished with an operculum; a single-pointed tooth arises from the anterior wall of each cell about its centre.*" A. H. Hassall.

Plate LVI. Fig. 4.

Lepralia semilunaris, *Hassall* in Ann. and Mag. Nat Hist. ix. 411. Lep. pustulata? *Couch.* Corn. Faun. iii. 113, pl. 22, fig. 2.

"Two or three specimens of the above well-marked species have occurred to me on old valves of *Pecten maximus*, trawled up off Bray, near Dublin; it is therefore most probably a deep-water species. Its distribution is not confined to Ireland, as I have since met with a single specimen on oyster-shells from Burnham, Norfolk. In some cells the anterior tooth is broken off, leaving an aperture in its place; there is also sometimes an appearance of two spines, one on either side the aperture, produced by the incomplete removal of the operculum." *A. H. Hassall.*

* * * * * Wall of the cell roughened.

29. Lepralia unicornis, *cells ovate, scaly, with a short obtuse process or knob above the aperture, which is roundish with a distinct sinus in the upper margin.*

Plate LVII. Fig. 1.

Berenicea coccinea, *Johnston* in Trans. Newc. Soc. ii. 267, pl. 12. fig. 5.—Lepralia coccinea, *Johns.* Brit. Zooph. 278, pl. 34. fig. 1-3. *Hassall* in Ann. and Mag. N. Hist. vii. 367. *Couch* Corn. Faun. iii. 115. *W. Thompson* in Ann. Nat. Hist. v. 253.

Hab. On rocks near low-water mark, and on the roots of the Laminaria digitata. Common.

Polypidom forming a closely adherent, calcareous crust, often an inch and upwards in diameter, tending to spread circularly, but frequently diverted from this its normal form, roughish to the naked eye, generally of a flesh-red or purplish colour, but sometimes pure white, and this colour it almost always acquires after being dried for some time. The cells are disposed in contiguous rows, separated by a furrow; they are either opposite or semialternate, ovate or urceolate, horizontal, the walls rough or scaly, rather thick and coarse, opaque or silvered, the aperture constricted, entire, roundish, with a sinus in the upper side, and over this there is an obtuse process originating a little behind the margin. In many of the cells towards the centre, there is on each side of the aperture, an obtuse obliquely truncate hollow process with a terminal slit, which seems to be the opening of an abortive or partially developed cell. The ovarian vesicles are globular, white, deeply grooved, the grooves radiating from the apex : they are produced often in great numbers, and are situated immediately above the aperture, between its rim and the mucro.

There is a variety of a silvery-white colour, with cells of a more globular shape, and thinner parietes. The character of the aperture is hence more distinctly defined, and its margin more raised.

30. L. Ballii, *cells shortly cylindrical, slightly raised, thick and granulous, the aperture circular with a mucro on the proximal margin, and a large open auricle on each side.*

Plate LVI. Fig. 5.

Hab. On various bivalve shells dredged off Sana Island by *G. C. Hyndman.* Coast of Cornwall, *C. W. Peach.*

A fine species, forming a rather thick white calcareous crust with an undefined margin, consisting of a single layer of rowed cells very obvious to the naked eye : cells contiguous, short, cylindrical, raised towards the aperture, the walls thick, opaque, rough with small

granules, the aperture wide, circular, with a more or less prominent mucro on the proximal side, and two wide open auricles or projecting loops at the side. In no instance has the trace of any spines been discovered; but the space between the bases of the cells is occasionally punctured. Ovarian capsules in front of the aperture, rather small, rounded, granulous.

Allied to Lepralia Hassallii. I have dedicated the species to an eminent naturalist, Robert Ball, Esq., of Dublin.

31. L. COCCINEA, *cells shortly cylindrical, rough, raised anteriorly, the aperture mucronated on the proximal and armed with four or five long spines on the distal margin.* Dr. Fleming.

PLATE LVII. FIG. 2, 3.

Cellepora coccinea, *Abildgaard* in Mull. Zool. Dan. iv. 30. tab. 146. fig. 1, 2. *Lam.* Anim. s. vert. 2de. édit. ii. 259.—Berenicea coccinea, *Flem.* Brit. Anim. 533.—Lepralia tridentata, *Couch* Corn. Faun. 115. pl. 22. fig. 5.

Var. β. with a triangular slit or loop on each side of the aperture. Lepralia appensa, *Hassall* in Ann.and Mag. Nat. Hist. vii. 367. pl. 9. fig. 3.

Hab. "On the under side of stones near low-water mark," *Fleming.* On Nullipora polymorpha from the Isle of Man, *E. Forbes.* Common on the coast of Cornwall, *C. W. Peach.* On Pholades from the Isle of Wight, *W. Thompson.* On the coast at St. Andrews, *Prof. Reid.* On Patella cœrulea from Falmouth, *W. P. Cocks.* Dredged off the Tees, *W. L. Thomas.*

Crust in circular spots of an orange-red, yellowish-brown, or, sometimes, white colour, closely adherent, the margin often darker coloured than the centre, and with unfinished cells: cells subconfluent, shortly cylindrical, rising towards the aperture, the walls roughish, glistening; the aperture wide, circular, with three denticles on the proximal side, of which the middle one is the largest and most prominent, and there are several long filiform spines projecting from the under lip. These spines are often not to be found in the central cells, but I have always found them in those of the margin: they are four or five in number and of unequal length. On each side of the aperture there is usually a large open loop or auricle, but cells with these auricles and without them are to be seen in most specimens. Ovarian capsules globular, rough.

Abeldgaard's description is as follows:—"Stratum planum coccineum. Cellulæ confertæ, diaphanæ, fundo coccineæ. Os orbiculare, unidentatum, margine denti opposito ciliato. Animal Hydra coccinea tentaculis æqualibus novem. Raro se exserit."

32. L. CILIATA, *cells ovato-globose, frosted, the aperture subcircular, marginated, armed with from three to seven long unequal spines, the upper side transverse and plain, with a knob or mucro behind it.*

PLATE LVII. FIG. 4, 5.

Eschara ciliata, var. β. *Pall.* Elench. 38.—Cellepora ciliata, *Lin.* Syst. 1286. *Fabr.* Faun. Groenland. 434, no. 441.—Berenicea utriculata, *Flem.* Brit. Anim. 533.—Lepralia ciliata, *Johns.* Brit. Zooph. 279. pl. 34. fig. 6. *Couch* Corn. Faun. iii. 118. pl. 22. fig. 10. *W. Thompson* in Ann. N. Hist. v. 253. *J. Macgillivray* in Ann. and Mag. N. Hist. ix. 467.

Var. β. with a long spine projecting from the side of the cell. Lepralia insignis, *Hassall* in Ann. and Mag. N. Hist. vii. 368. pl. ix. fig. 5. *Couch* Corn. Faun. pl. 22. fig. 11. *J. Macgillivray* in Ann. and Mag. N. Hist. ix. 467.

Hab. Parasitical on sea-weeds, — "specimen in Fucis maris Anglici observavi," *Pallas;* and frequent also on rocks and shells.

Crust forming small circular patches closely adherent to their foreign base and of a white or greyish-white colour, composed of small utricular cells arranged in regular semialternating series, and so distinctly separated that they "appear as unconnected though adjacent." Cells horizontal, ovato-globose, bulged posteriorly, narrowed forwards, the walls frosted and silvery, the aperture roundish or semicircular, armed with five or seven stout cylindrical spines of which the three that jut from the lower lip are very long, while those on the sides do not usually exceed the diameter of the cell. The upper lip is always unarmed, and behind it there is a prominent knob or mucro, often perforated on the top. The ovarian capsules are large and globose, opaque pearly-white, and slightly frosted. In many specimens there is a triangular loop or hole which protrudes from between the cells.

The description which Pallas has given of it leaves no doubt, in my mind, that this is the species he had in view when describing his var. β :—"*Crustæ* albæ ; substania cellularum tenuissima, subpellucida, lapidescens. *Cellulæ* extus læves, convexæ, ore dentibus subulatis circiter sex ciliato, sed inferiori labio semper inermi. In hujus crustis passim sæpe generatas vidi vesiculas arcuatas, cellularum orificiis imminentes, quas pro ovariis ut habeam multa suadent. Hanc eandem Escharam etiam in Coralliis Americanis passim observavi."

The *Lep. insignis* of Hassall is distinguished by a spine, similar to those of the aperture, projecting from the side of the cell low down and near its confluence with the one adjacent. The spine is

"sometimes on one side and sometimes on the other" (*C. W. Peach*), and when it is broken off a small hole marks where it had been.

33. L. SPINIFERA, *cells ovato-globose, roughish, contracted in front; aperture circular with a sinus in the upper lip and a mucro behind it, the margin with from three to five spines on its lower side.* A. H. Hassall.

PLATE LVII. FIG. 6.

Lepralia ciliata, *Hassall* in Ann. and Mag. Nat. Hist. vi. 171; and vii. 367. pl. 9, fig. 2.

Hab. "Rather abundant on stones, shells, and fuci; Dublin Bay," *A. H. Hassall.*

This species closely resembles Lep. ciliata; indeed I can perceive little or no difference excepting what exists in the different shape of the aperture, which is abundantly characteristic. The walls of the cells are thin, silvered, and roughish, sometimes punctured, but this appears to be the effect of drying. The mucro in front varies in length, and is often hollow or perforated. The spines of the aperture are longer than its diameter.

Lep. spinifera is probably a rare species. I have seen no specimen but the one I owe to the kindness of Mr. Hassall.

34. L. TRISPINOSA, *cells radiating from a centre, horizontal, ovate, ventricose, rough; the aperture small and circular, sinuated on the proximal and armed with three long spines on the distal margin.* G. J.

PLATE LVII. FIG. 7.

Discopora trispinosa, *Johnston* in Edin. Phil. Journ. xiii. 322.—Berenicea trispinosa, *Johnston* in Trans. Newc. Soc. ii. 268.—Lepralia trispinosa, *Johns.* Brit. Zooph. 280, pl. 34. fig. 5. *Couch* Corn. Faun. iii. 118. *J. Macgillivray* in Ann. and Mag. N. Hist. ix. 467.

Hab. On shells from deep water, rare. Berwick bay, *G. J.* Coast of Cornwall, *C. W. Peach.* On a root of Laminaria digitata, near Aberdeen, *J. Macgillivray.*

Crust thin, circular, adherent, yellowish, or of a silvery white colour, thickly sprinkled with minute yellow dots: cells in rows radiating from the centre, horizontal, immersed, rough or subgranular, the apertures raised, round, cleft, but not deeply, above, and below armed with three stout and long spines of which the middle one is usually the longest.—The margin of the crust is a thin pel-

licle marked with the raised lines which are to form the partitions between the future cells.

35. L. IMMERSA, *cells ovate immersed in the crust, with roundish apertures having a tooth on the proximal and several spines on the distal margin.* G. J.

PLATE LVII. FIG. 8.

Berenicea immersa, *Flem.* Brit. Anim. 533.—Berenicea flava, *Johnston* in Trans. Newc. Soc. ii. 268.—Lepralia immersa, *Johns.* Brit. Zooph. 280. pl. 34. fig. 8. *W. Thompson* in Ann. N. Hist. v. 253. *Couch* Corn. Faun. iii. 118.

Hab. On shells and stones from deep water, frequent.

Crust rather thick, spreading irregularly, ochre-yellow, or sometimes cream-yellow, roughish and punctured to the naked eye by the apertures of the cells which do not radiate from a centre, though arranged in regular series. They are ovato-ventricose and frosted, but commonly immersed in the crust so that their divisions are indistinct; the apertures contracted with a tooth on the upper edge and several spines on the lower margin which are very brittle and liable to be broken off, but when entire are rather longer than the diameter of the cell.

The oral spines encircle two-thirds of the aperture. Towards the centre of the crust they are not longer than the diameter of the cell and pretty equal in general; but those on the inferior edge of the marginal cells, where these are protected or new, are always much longer. From this circumstance this species may be easily confounded with *Lep. ciliata,* from which it differs in having a thicker and more solid texture, in forming larger leprous patches, in the much less distinctness of the cells, in the aperture having no rim but a slight projection or denticle in the upper margin, and in there being no knob behind it. The species is nearly allied to *Lep. variolosa* in habit and texture.

36. L. VIOLACEA, *crust purplish; cells ovate, glistening, roughish, with a contracted round and unarmed aperture, and an obtuse mucro behind the upper margin.* E. Forbes.

PLATE LVII. FIG. 9.

Hab. On Nulliporæ from the Isle of Man, *E. Forbes.* On a laver-covered stone from the Coast of Cornwall, *C. W. Peach.*

Polypidom forming a lavender-purple closely adherent crust of a

subcircular form, about an inch in diameter, with an unfinished cellular margin : cells compact, contiguous, of the size of those of Lep. unicornis, horizontal, ovate, with rather thick roughish or squammulose silvered walls, and a small unarmed aperture which is sometimes labiate, having the inferior margin turned up a little, but in the cells at the circumference the shape is circular, with an even upper rim. There is an obtuse knob on the back, and near the middle of it, very often, a small perforation. The central cells are more or less immersed and coalescent ; those near the margin are distinctly defined ; and the space between them has often an areolated appearance, leading to the belief that it might ultimately become punctured or fissured as in Lep. variolosa. The species is indeed nearly allied to the latter ; and the most distinguishing character may be the purple colour of the crust, which is quite peculiar to Lep. violacea.

37. L. BISPINOSA, *cells distinct, ovato-ventricose, frosted ; the aperture subquadrangular, uneven, armed with a strong mucro projecting from the centre of the upper lip, and with two long cylindrical spines originating from the angles of the lower lip.*

PLATE LVII. FIG. 10.

Hab. On Modiola vulgaris from Berwick Bay.

This species has a very close resemblance to Cellepora pumicosa in its crustaceous or primary state. It is of a white colour, roughish, with distinct cells, arranged, as usual, in semialternating rows and rising towards the distal extremity. The cells are ovate with glistening or silvery frosted walls ; the aperture quadrangular, uneven, armed with a stout mucro projecting from the upper lip, and with two very long cylindrical spines which originate from the angles of the lower lip. The rim of the aperture is opaque and smooth.

The labial mucro varies in length, as does also the degree of unevenness of the sides. The infra-labial spines are seldom to be seen excepting on the new or marginal cells.

Extensive as this list of Lepraliæ is, I have some specimens which I cannot refer confidently to any of the species described. When a more precise knowledge of it has been acquired, a subdivision of the

genus will become necessary; and I have to remark that the sections into which I have thrown the species are quite artificial. They may, perhaps, be more naturally arranged under three sections as follows: I. Cells laid on a thin basilar circumscribed crust: L. hyalina, tenuis, assimilis, granifera, and Landsborovii.—II. Cells complete, simply aggregate, not circumscribed: L. Hassallii, simplex, ventricosa, Hyndmanni, ansata, ciliata, spinifera, annulata, figularis, biforis, Peachii, Ballii, pertusa, punctata, ovalis, pediostoma, verrucosa, and unicornis.—III. Cells confluent, forming a crust in which they are more or less immersed, the margin of the crust unfinished or marked with lines which are the commencement of new cells: L. auriculata, linearis, coccinea, trispinosa, immersa, and violacea.

14. Membranipora,* Blainville.

Character.—*Polypidom encrusting, membrano-calcareous, spreading irregularly, formed of a single layer of alternating approximated cells; cells oval, horizontal, membranous, the aperture patulous with a hard calcareous rim.*

1. M. pilosa, *aperture of the cell with one long hair and several spinous denticles.* Ellis.

Plate LVI. Fig. 6.

Irregular spongy foliaceous Coralline, *Ellis* Corall. 73. no. 4. pl. 31.—Eschara pilosa, *Pall.* Elench. 50.—Flustra pilosa, *Lin.* Syst. 1301. *Mull.* Zool. Dan. prod. 253. *Ellis* and *Soland.* Zooph. 13. *Esper* Pflanz. Flust. tab. 4. fig. 1, 2. *Berk.* Syn. i. 214. *Lam.* Anim. s. vert. ii. 159: 2de édit. ii. 224. *Grant* in Edin. New Phil. Journ. iii. 111. *Flem.* Brit. Anim. 537. *Risso* L'Europ. Merid. v. 335. *Johnston* in Trans. Newc. Soc. ii. 265. pl. 9. fig. 5. *Lister* in Phil. Trans. an. 1834, 384, pl. 12. fig. 2. *Templeton* in Mag. Nat. Hist. ix. 469.—Membranipora pilosa, *Johns.* Brit. Zooph. 280. pl. 34. fig. 10-12. *Couch* Corn. Faun. iii. 119. *Van Beneden* Recherch. 53. pl. 7. fig. 1-10.

Var. α. Polypidom assuming a stellate form. Membranipora stellata, *W. Thompson* in Ann. Nat. Hist. v. 101. *Hassall* in Ann. and Mag. N. Hist. vii., 369.

Var. β. The long bristle abortive or destroyed. *Ellis* Corall. pl. 29. fig. *D.* *Ellis* in Phil. Trans. abridg. x. 492. pl. 12. fig. 4. *D.*—Flustra dentata, *Ellis* and *Soland.* Zooph. 15. *Turt.* Brit. Faun. 209. *Lam.* Anim. s. vert. ii. 158: 2de édit. ii. 224. *Templeton* loc. s. cit. 469.—Flustra lineata, *Esper* Pflanz. Flust. tab. 6.—Membranipora pilosa, *Farre* in Phil. Trans. an. 1837, 412, pl. 27, fig. 1-5.

Hab. On the Laminariæ and lesser sea-weeds most abundant, and not uncommon on old shells.

Polypidom incrusting, membrano-calcareous, irregular, following the shape and form of the objects it grows upon, straw-yellow, thick-

* From *membrana*, a thin skin or film, and πορος.

ish, porous, hairy: cells short, somewhat tubulous, with large roundish apertures ossified and toothed on the margin, the teeth short, sharp, and rigid, and behind the mouth of each cell there is a very long tubular bristle which issues from a hollow base like a hair from its bulb.—Polypes with twelve tentacula, long in proportion to the body, thick and rather clumsy. *Farre.* "Polypus—tentacula circiter viginti, æqualia et corpus æquantia, in campanæ formam expandit." *Pallas.*

When the polypidom encrusts the broad-leaved fuci or shells the texture is thinner and the cells more completely developed, and then their surface is perceived to be finely frosted, or rather specked with numerous translucid granules. The small spines of the aperture are omitted in the figure of Ellis; and that referred to for the variety *dentata* is imperfect and unfinished. Many believe this variety to be distinct in species, and specimens, sufficiently characteristic, can easily be produced in favour of the opinion, which, however, I am satisfied is erroneous.

M. pilosa often rises into small sponge-like fronds, cellular and hirsute on each side. "In frondes lubenter assurgit, utrinque cellulosas crassiusculas, spongiosas; primo simplices, lineares, obtusas; deinde ramosas; imo pinnato-multifidas fere nunquam pollice longiores." *Pallas.*

2. M. MEMBRANACEA, "*cells ovate or subquadrangular, with a blunt hollow conical process at the summit of each.*" Fleming.

PLATE LVI. FIG. 7.

Flustra membranacea, *Mull.* Zool. Dan. prod. 253, no. 3054. Zool. Dan. iii. 63, tab. 117, fig. 1, 2. *Fabric.* Faun. Groenl. 437. *Lamour.* Corall. 47.—Flustra unicornis, *Fleming* in Edin. Phil. Journ. ii. 87. *Flem.* Brit. Anim. 236. *Blainv.* Actinolog. 450. *Johnston* in Trans. Newc. Soc. ii. 266.—Membranipora unicornis, *Blainv.* lib. cit. 447.—Flustra tuberculata, *Johns.* Brit. Zooph. 289. *Bosc?* Vers. iii. 143.

Hab. "Common, especially on stones, near low-water mark," *Fleming.* I have never seen it on sea-weed.

Polypidom in the form of a thin closely-adherent, greyish-white, subcalcareous crust, reticulated like a piece of gauze to the naked eye, spreading circularly: cells quincunxial, short, with a large ovate or subquadrangular aperture, the margin of which is slightly thickened, and usually unarmed; but in the space between the cells, and above the aperture, there is a stout hollow conical process, mostly

perforated on the top. Ovaria rather small, globose, rough, and shining with a pearly lustre; the aperture lateral and circular.

This is more calcareous in its texture than the preceding, and hence assumes a white colour when dried. When perfect and young there are two short spinous teeth on the sides of the cell inclined inwards, but in old or exposed specimens no vestige of them can be discovered. In the same specimen a considerable difference in the shape of the aperture of different cells often exists, from a wide and perfect oval to a short angular form, and on each side of the former we may commonly detect a small auricle or perforation. Many of the cells, too, are sometimes furnished with a broad reflected calcareous lip to the lower side of the aperture.

"Animal hydra pellucida hyalina, corpore cylindrico, in extensione cellulis duplo longiore, tentaculisque duodecim in formam infundibuli extensis terminato.

"Vix ultra octo dies vivunt hæc animalcula, sed progenie numerosa brevi tempore ad marginem augentur prolifera, dum centro propriora moriuntur. Præterea ovulis deciduis multiplicantur et in hoc ut in cæteris cum Brachione tubifice Ill. Pallas mores similes habet.

"Ovaria ut in Sertulariis plurimis nunquam vidi nec in hoc nec in aliis flustrarum speciebus, sed more hydrarum ovula excernunt." *Muller.*

FAMILY—ESCHARIDÆ.

Several species in this family are distinguished by the possession of certain singular moveable organs which have been compared to a bird's head in miniature, and which are attached to the sides of the cells. Mr. Charles Darwin has made some interesting observations on them in species collected on the shores of Terra del Fuego and of the Falkland Islands, which I shall copy in this place, for I have verified their exactness in our native species. He says,—"The organ, in the greater number of cases, very closely resembles the head of a vulture; but the lower mandible can be opened much wider, so as to form even a straight line with the upper. The head itself possesses considerable powers of movement, by means of a short neck. In one zoophyte the head itself was fixed, but the lower jaw free; in another it was replaced by a triangular hood, with a beautifully-fitted trap-door, which evidently answered to the lower mandible. A species of stony eschara had a structure somewhat similar. In

the greater number of species, each cell was provided with one head, but in others each had two.

"The young cells at the end of the branches necessarily contained quite immature polypi, yet the vulture-heads attached to them, though small, were in every respect perfect. When the polypus was removed by a needle from any of the cells, the organs did not appear in the least affected. When one of the latter was cut off from a cell, the lower mandible retained its power of opening and closing. Perhaps the most singular part of their structure is, that when there were more rows of cells than two, both in a Flustra and an Eschara, the central cells were furnished with these appendages, of only one-fourth the size of the lateral ones. Their movements varied according to the species:—in some I never saw the least motion; while others, with the lower mandible generally wide open, oscillated backwards and forwards at the rate of about five seconds each turn; others moved rapidly and by starts. When touched with a needle the beak generally seized the point so firmly, that the whole branch might be shaken.

"These bodies have no relation whatever with the production of the gemmules. I could not trace any connection between them and the polypus. From their formation being completed before that of the latter; from the independence of their movements; from the difference of their size in different parts of the branch; I have little doubt that in their functions they are related rather to the axis than to any of the polypi. In a similar manner, the fleshy appendage at the extremity of the sea-pen forms part of the zoophyte as a whole, as much as the roots of a tree do of the whole and not of the individual buds. Without doubt this is a very curious variation in the structure of a zoophyte: for the growing part in most other cases does not manifest the least irritability or power of movement.

"I will mention one other kind of structure quite as anomalous. A small and elegant Crisia is furnished, at the corner of each cell, with a long and slightly curved bristle, which is fixed at the lower end by a joint. It terminates in the finest point, and has its outer or convex side serrated with delicate teeth or notches. Having placed a *small* piece of a branch under the microscope, I was exceedingly surprised to see it suddenly start from the field of vision by the movement of these bristles, which acted as oars. Irritation generally produced this motion, but not always. When the coralline was laid flat on that side from which the toothed bristles projected, they were necessarily all pressed together and entangled.

This scarcely ever failed to excite a considerable movement among them, and evidently with the object of freeing themselves. In a small piece, which was taken out of water and placed on blotting-paper, the movement of these organs was clearly visible for a few seconds by the naked eye.

"In the case of the vulture heads, as well as in that of the bristles, all that were on one side of a branch, moved sometimes coinstantaneously, sometimes in regular order one after the other; at other times the organs on both sides the branch moved together; but generally all were independent of each other, and entirely so of the polypi. In the Crisia, if the bristles were excited to move by irritation in any one branch, generally the whole zoophyte was affected. In the instance where the branch started from the simultaneous movement of these appendages, we see as perfect a transmission of will as in a single animal. The case, indeed, is not different from that of the sea-pen, which when touched drew itself into the sand. I will state one other instance of uniform action, though of a very different nature, in a zoophyte* closely allied to Clytia, and therefore very simply organized. Having kept a large tuft of it in a basin of salt water, when it was dark I found that as often as I rubbed any part of a branch, the whole became strongly phosphorescent with a green light; I do not think I ever saw any object more beautifully so. But the remarkable circumstance was, that the flashes of light always proceeded up the branches, from the base towards the extremities.

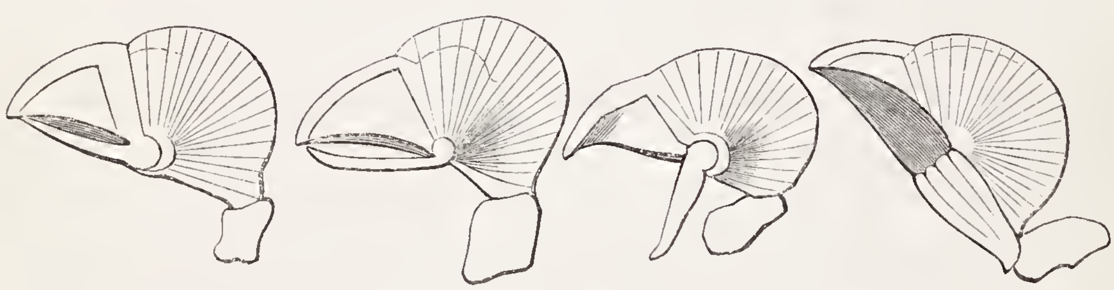
"The examination of these compound animals was always very interesting to me. What can be more remarkable than to see a plant-like body producing an egg, furnished with setæ, and having independent movements, which soon becomes fixed, branches into numberless arms, and there, though crowded with polypi, yet in some cases possessing independent organs of movement, and obeying uniform impulses of will? The polypi are frequently animals of no simple organization; and in most respects certainly are to be considered as true individuals. It is therefore more curious to observe, in the young and terminal cells, their gradual formation, from the growth of the simple horny substance of which so many zoophytes are composed. The known organization of a tree should remove all surprise at the union of many individuals together, and their relation to a common body. Indeed we might expect, according to the ap-

* "This coralline emitted a very strong and disagreeable odour, when freshly taken from the sea."

parent law, that any structure which prevails in one class will be produced in a lesser degree in some others—that since so many plants are compound, so would some animals be thus constructed. It requires, however, a greater effort of reason to view a bud as an individual, than a polypus furnished with a mouth and intestines; and therefore the union does not appear so strange.

"Our conception of a compound animal, where in some respects the individuality of each is not completed, may be aided, by reflecting on the production of two distinct creatures by bisecting one with a knife, or where nature herself performs the task. We may consider the polypi in a zoophyte, or the buds in a tree, as cases where the division of the individual has not been completely effected. In this kind of generation, the individuals seem produced only with relation to the present time; their numbers are multiplied, but their life is not extended beyond a fixed period. By the other, and more artificial kind, through intermediate steps or ovules, the relation is kept up through successive ages. By the latter method many peculiarities, which are transmitted by the former, are obliterated, and the character of the species is limited; while on the other hand, certain peculiarities (doubtless adaptations) become hereditary and form races. We may fancy that in these two circumstances we see a step towards the final cause of the shortness of life."—Voyages of Adventure and Beagle, vol. iii. p. 259-62.

Fig. 65.



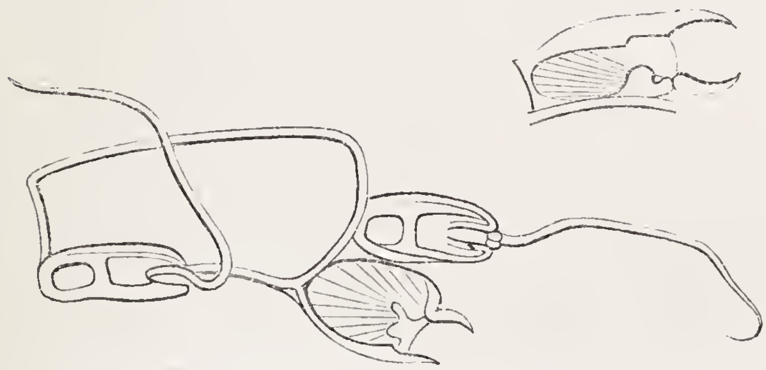
These "Bird's-head processes" have recently been described with great care by Van Beneden and Professor John Reid.* Of British Zoophytes they have been found on Cellularia ciliata, avicularia, plumosa, scruposa and reptans, on Flustra avicularis and murrayana, on Retepora cellulosa, and, as Lieut. Thomas writes me, on Lepralia ciliata and coccinea. They are not present on every specimen of any

* Nordmann and Krohn have also described them, but the works of these authors are not accessible to me.

of these species, and indeed are very rarely to be seen on some of them; and when present it is only upon some of the cells. Krohn has classified them under three different forms: (1) Those which have the figure of the crab's arms; (2) those which resemble pincers; and (3) those which are formed like bristles or hairs. The first kind, or proper "bird's head" process, is found on Cellularia avicularia and ciliata, and on Flustra avicularis and murrayana; and the second, which only differs from the first in the absence of a moveable pedicle, on the Cellularia scruposa and Retepora cellulosa. Both kinds are always placed on the outer edge of the cell which produces them, and the first are articulated to it, so that they move freely up and down on the basal joint. Besides their pendulum-like motion, they can also shut and close their "bills" at pleasure; and all these motions are affected by appropriate muscles. Van Beneden has traced their growth step by step, and studied all the phases of their development, but without obtaining any clue to their use or purpose in the economy of the polype. Pallas suspected that they had some connection with the reproductive function, but this is very improbable. Dr. Reid has thrown out a conjecture that they may assist in circulating water along the canals in the different processes of the cell.

To the third form belong the more or less elongated bristles which are observed on the external margin of the cells, and every cell of the polypidom is equally furnished with them. They are found in Cellularia scruposa, reptans and Hookeri, and are minutely described by Van Beneden and Dr. Reid. A figure copied from the former will give a better idea of the structure than a more elaborate description. (Fig. 66.) Dr. Reid gives this short summary of his more detailed account: "At the anterior part of the outer side of each cell in the

Fig. 66.



Cellularia scruposa, and immediately in front of the tooth-like process there attached, are two pretty long spines and a rounded process, which tapers slightly from its fixed to its free extremity. This rounded process is open at the top, and is hollow in dead specimens; but when alive it is full of a contractile substance. In this contractile substance the end of a hair-like curved filament, about the length of the cell, is immersed. This hair-like filament is moved about by the contractile substance attached to it, generally in jerks after intervals of repose, and in its movements sweeps the anterior and posterior surfaces of the cell to which it is fixed. These movements continue for a considerable time after the animal inhabiting the cell has been dead. A hollow rounded process, with a hair-like curved and moveable filament projecting from it, is also fixed upon the corresponding part of each cell of the Cellularia reptans. These moveable hair-like filaments are analogous to the moveable bird-head process attached to each of the cells of Flustra avicularis."

The organic relations of these appendages are very obscure, for nothing similar is to be found in any other class of animals; and the use of them to the polypes is merely conjectural. This may be two-fold. By those formed in the model of pincers the polype may seize circumfluent animalcules, for although they are too short to hand the prey to the mouth, yet retained in a certain position, and enfeebled or killed by the grasp, the currents set in motion by the ciliated tentacula, may then carry it within reach. The hair-like bristles are more probably organs to drive away any injurious particles or animalcules that might seek an entrance into the cells. Professor Reid says,—"The use of these hair-like prolongations may probably be to keep the surface of the polypidom clear of substances which would otherwise adhere to it. Their motions are executed with more force than we should at first suspect. I have seen one of them in its course encounter the stalk of a *Pedicellina echinata*, and press it aside."

15 Cellularia,* Pallas.

Character.—*Polypidom calcareous or membrano-calcareous, confervoid, divided dichotomously, the divisions narrow, composed of two or three alternating series of oblong contiguous cells on a single plane, the apertures lateral, oblique and facing one way. Polypes ascidian with usually* 14 *tentacula; no gizzard.*

* From *cellula*, the diminutive of *cella*, a cell.

* Aperture of the cell terminal.

1. C. CILIATA, *erect, dichotomous ; cells alternate, turbinate, the aperture open, oblique, and spinous on the outer edge.* Ellis,

PLATE LVIII. FIG. 1, 2.

Ciliated Coralline, *Ellis* Corall. 38, no. 5, pl. 20, *d. D.*—Sertularia ciliata, *Lin.* Syst. 1316. *Berk.* Syn. i. 220. *Esper* Pflanz. Sert. tab. 14, fig. 1, 2.—Cellularia ciliata, *Pall.* Elench. 74. *Flem.* Brit. Anim. 540.—Cellaria ciliata, *Ellis* and *Soland.* Zooph. 24. *Lam.* Anim. s. vert. ii. 139: 2de. édit. ii. 186.—Crisia ciliata, *Lamour.* Corall. 60. *Templeton* in Mag. Nat. Hist. ix. 468. *Van Beneden* Mem. 51, pl. 6. fig. 9-11.—Bicellaria ciliata, *Blainv.* Actinol. 459.—Cellularia ciliata, *Johns.* Brit. Zooph. 290, pl. 38, fig. 1, 2. *Couch* Zooph. Cornw. 56 : Corn. Faun. iii, 126, pl. 23, fig. 1.

Hab. Parasitical on corallines and the roots of Fuci, within low-water mark, not uncommon. Sparingly found on algæ and zoophytes around the coast of Ireland, *W. Thompson.*

Tufted, about half an inch in height, very slender and delicate, hispid, pellucid white, calcareous, dichotomously branched. The cells are rather widely alternate, turbinate, with the apertures terminal, everted, patulous, and armed with four or five long spines on the outer edge which are apt to be broken off. There is also a similar spine on the inner side of the cell originating a little below its margin. The spines appear to be tubular. A saccate pearly lid covers the mouth of many cells ; and at or near the base there is, on some of them, a small anomalous appendage something like a bird's head. The pellucidity and delicacy of this species, with its pearly lids scattered over the branches, render it a remarkably beautiful object under the microscope.

"The polypes are ascidian, with from twelve to sixteen tentacula. I have observed the number of tentacula to vary in many ascidian polypes." *E. Forbes.*

2. C. TERNATA, *diffuse, branched dichotomously ; "cells ternate, with a joint above and below ; mouths ovate, with sessile margins."* Dr. David Skene.

PLATE LIX.

Cellaria ternata, *Ellis* and *Soland.* Zooph. 30.—Sertularia ternata, *Turt.* Gmel. iv. 687.—Crisia ternata, *Lamour.* Corall. 61.—Tricellaria ternata, *Flem.* Brit. Anim. 540. *Blainv.* Actinolog. 458.

Hab. "Sent from Aberdeen by the ingenious Dr. David Skene," *Ellis.* "My specimens were found in Zetland," *Fleming.* From deep water at Scarborough, attached to a valve of Cytherea ovata ;

also on Plumularia falcata and Sertularia abietina, not rare, *W. Bean.*

Polypidom confervoid, spreading, rooted by some long filiform tubular fibres, about an inch in height, white and calcareous, much branched dichotomously, the divisions short, patent, slender: cells triad, long, narrow at their origin, growing wider upwards, smooth and crystalline, the aperture subterminal, oval, with a raised bony rim armed above with two or three short obtuse spines that are frequently obsolete or broken away. There is a distinct joint between every three cells which thus form a set, having the apertures all on one plane, and rising a little above each other or subalternating; the two lower cells have a projecting angular shoulder opposite the aperture, while from the corresponding sides of the upper one originate the new triads of cells. The joints are of a less calcareous texture than the cells. This is evidently a Cellularia, connecting, however, that genus with Crisia, to which latter it is affined by its habit, its vitreous texture, and the great length of the cell in proportion to the diameter of the aperture. This, in dried specimens, is covered over with a membrane leaving a circular hole above, and forming a sort of operculum when the living polype lies hid in a state of retraction.

* * Aperture superior, subterminal, oval.

3. C. SCRUPOSA, *creeping, dichotomous; cells alternate with a plain aperture,* "*an angle projecting on the outward side of each.*" Ellis.

PLATE LVIII. FIG. 5, 6.

Creeping stony Coralline, *Ellis* Corall. 38, no. 4. pl. 20. *c*, *C.*—Celliferous Coralline with angular edges to its cells, *Ellis* in Phil. Trans. xlviii. pl. 13, no. 7. Phil. Trans. abridg. x. 493, pl. 12, fig. 7, *K*, *L.*—Sertularia scruposa, *Lin.* Syst. 1315. *Esper* Pflanz. Sert. tab. 15. fig. 1-3. *Berk.* Syn. i. 220.—Cellularia scruposa, *Pall.* Elench. 72. *Flem.* Brit. Anim. 539. *Couch* Zooph. Cornw. 57: Corn. Faun. iii. 126, pl. 23, fig. 2. *Reid* in Ann. and Mag. Nat. Hist. xv. 69: and xvi. 388.—Cellaria scruposa, *Ellis* and *Soland.* Zooph. 23. *Bosc* Vers. iii. 132, pl. 29, fig. 7. *Lam.* Anim. s. Vert. ii. 141: 2de édit. ii. 192. *Johnston* in Trans. Newc. Soc. ii. 261, pl. 11, fig. 5.—Crisia scruposa, *Lamour.* Corall. 60. *Templeton* in lib. cit. ix. 469.—Bicellaria scruposa, *Blainv.* Actinol. 459.—Scrupocellaria scruposa, *Van Beneden* Recherch. 43, and 50, pl. 5, fig. 8-16.

Hab. On the roots of Laminaria digitata, on Flustræ, corallines and old shells, common.

This frequently covers a space about an inch square, the branches diverging and creeping along the surface or the entangled roots of sea-weed, to which they are attached by simple tubulous root-like

fibres pullulating from the plane inferior surface. The branches are rather broad, dichotomous, of an earthy brown colour, brittle when dry. Within the cells I have occasionally seen a nearly globular orange-coloured ovum, and sometimes two ova.

The mouth of the cell is very regular, oval, and margined. An operculum, similar to that of the Flustræ, rises in front to give a passage to the polype. On each side of the cell, in front, there are two slender, straight, and rather long calcareous spines. The cells are contiguous on the inner side throughout their length, and are biserial. To each cell there are two appendages, of which the innermost is in the form of pincers fixed at the base, and the other is furnished with a long moveable bristle. The tentacula are proportionably long and arranged in a funnel-shaped circle; their number varies from twelve to sixteen. The gullet is short, coloured like the stomach, and there is no valve in the middle of its course. There are cilia at the pylorus of the stomach, but no gizzard. The intestine is short like the gullet. The retractor muscles are easily to be distinguished. *Van Beneden.*

4. C. REPTANS, *creeping, dichotomous; cells with an oblique aperture armed with short spines at the top.* Ellis.

PLATE LVIII. FIG. 3, 4.

Creeping Coralline, *Ellis* Corall. 37, pl. 20, no. 3, fig. *b. B.*—Sertularia reptans, *Lin.* Syst. 1315. *Fabric.* Faun. Grœnl. 445.—S. repens, *Berk.* Syn. i. 220.—Cellularia reptans, *Pall.* Elench. 73. *Flem.* Br. Anim. 540. *Johns.* Brit. Zooph. 291, pl. 38, fig. 3, 4. *Couch* Zooph. Cornw. 57: Corn. Faun. iii. 127, pl. 23, fig. 3. *Reid* in Ann. and Mag. N. Hist. xvi. 385.—Cellaria reptans, *Ellis* and *Soland.* Zooph. 23. *Lam.* Anim. s. Vert. 2d. edit. ii. 191. *Johnston* in Trans. Newc. Soc. ii. 262.—Crisia reptans, *Lamour.* Corall. 60. *Templeton* in Mag. Nat. Hist. ix. 469.—Bicellaria reptans, *Blainv.* Actinolog. 459.

Hab. On Flustra foliacea and other submarine bodies, especially algæ, common.

Similar to the preceding in form and mode of growth, but its spreading tufts cover in general a larger space, and are more densely matted. The radical tubes are flexuous, corneous, and divided at the extremity into two or three small knob-like processes. Branches linear, plane, jointed at their origins, composed of two rows of semi-alternate oval cells, with an oblique subterminal aperture level with the surface, and armed with several short brittle spines. Ellis represents only two spines to each cell, and Pallas follows him in his description, but they are commonly more numerous. Mr. Couch

says, "they most commonly amount to three or four, and very rarely indeed to five; but whether two, three or four, the same number generally pervades the whole specimen." Ovarian capsules are to be seen over some cells, but these are not common.

Mr. W. Thompson has, in his collection, a specimen on an alga from Van Diemen's Land: and it has been gathered at Gibraltar by Dr. J. L. Drummond.

Professor Reid has given a very complete description of the animal.

5. C. HOOKERI, "*cells rounded, diverging, projecting.*" Sir W. J. Hooker.

PLATE LX. FIG. 1, 2.

Cellularia Hookeri, *Flem.* Brit. Anim. 539.

Hab. "Found by Dr. Hooker at Torquay, 1812," *Fleming.* Zetland, *E. Forbes.*

"Height upwards of an inch, dichotomously branched, branches straight, stiff, brittle, divaricate; the cells are protuberant dorsally, and their rounded top is nearly free, projecting laterally, giving the edge a remarkably jagged outline, and the pearly ovaria are rounded." *Fleming.*

Polypidom erect, affixed by a fibrous base, frondose, dichotomously divided, the segments narrow, linear, subcylindrical, striated or ribbed on the inferior or outer surface, an appearance produced by the root-fibres running up it. Cells opening on the upper or inner aspect only, arranged in three rows, oval, adhering throughout, with a moderately sized oval aperture, having a triangulate process on the outside; and from near the base of some of the cells there arises a long setaceous bristle that bends over the upper surface of the polypidom. This bristle is armed with a few spinules on its outer edge, and is moveable. Ovarian capsules globular, smooth, pearly.

Very like Cellularia neritina in habit, but more allied to C. scruposa and reptans. I have seen only one specimen, for which I am indebted to Professor Edward Forbes. It is nearly an inch in height, and of a brownish colour.

* * * Apertures superior and very large.

6. C. AVICULARIA, *erect, dichotomous, the divisions rather broad; cells with a helmet-like figure over the opening, and two spines on the top of each; on the outward margin a bird's-head process.* Ellis.

Plate LXIII. Fig. 7, 8.

Bird's-head Coralline, *Ellis* Corall. 36, no. 2, pl. 20, fig. *a. A*.—Cellularia avicularia, *Pall.* Elench. 68. *Johns.* Brit. Zooph. 292, pl. 36, fig. 7, 8. *Couch* Zooph. Corn. 58: Corn. Faun. iii. 128. *Van Beneden* Recherch. 41 and 48, pl. 6, fig. 1-8.—Sertularia avicularia, *Lin.* Syst. 1315. *Berk.* Syn. i. 220.—Cellaria avicularia, *Ellis* and *Soland.* Zooph. 22. *Lam.* An. s. Vert. 2de. édit. ii. 191. *Johnston* in Trans. Newc. Soc. ii. 262.—Crisia avicularia, *Lamour.* Cor. Flex. 141. *Templeton* in Mag. Nat. Hist. ix. 468.—Cellularia avicularis, *Reid* in Ann. and Mag. Nat. Hist. xvi. 389.

Hab. Parasitical on other corallines in deep water.

Polypidom caulescent, erect, bushy, from one to two inches in height, membrano-calcareous, silvery or glassy greyish-white, brittle when dry, attached by a fibrous root, the stalk composed of numerous interwoven fibres; primary branches alternate, flabellate, divided dichotomously into many narrow linear flat segments, which are rough and cellular on the upper or inner side, but smooth and longitudinally striate underneath. Cells in two semialternating rows, coalescent, opening on one plane, oblong, flat, their parietes thin and pellucid, a strong spine at each of the superior angles, the aperture subterminal, transverse, generally covered with a large globular pearly operculum placed between the spines; and at the external side there is in many a curious appendage which Ellis has aptly compared to a "bird's head, with a crooked beak, opening very wide." These appendages, of unknown use, are about one fourth the size of the cell, and, when the coralline is in a living state, are continually moved upwards and downwards with the regularity of a pendulum. The polypes have apparently twelve tentacula.

Many naturalists make this zoophyte a variety of Flustra avicularis, but Mr. Bean and Milne Edwards dissent from the association. The principal distinction between them lies in the dissimilarity of their habit: in the shape of the cells I do not perceive any noticeable difference. "It can, however, be readily distinguished from the latter (*Flustra avicularis*) by all the branches being composed of two rows of semi-alternate cells, and each cell having only two conical spines directed upwards or in the line of the long axis of the cells, and a little outwards and forwards, and attached to the angles of the superior margin of the cell. In a small number of cells an additional small spine, making three in all, projected from the outer angle in the same direction as the normal one. On the other hand, almost all the cells in *Flustra avicularis* have four spines, which differ in appearance from those of *Cellularia avicularis.* This spe-

cimen when dried assumed only a very faint ash-colour, very different from the much deeper ash-colour in all the dried specimens of *Flustra avicularis* I have seen." *Professor J. Reid.*

Van Beneden has assumed this species as the type of the genus Cellularia. He has given a very minute anatomy of its bird's-head processes. The polype has fourteen tentacula, and the aperture at which it issues from the cell is very large and without a distinct rim.

* * * * Apertures lateral and very large.

7. C. NERITINA, "*cells quadrangular, lengthened, with a truncated summit, the outer angle projecting.*" Miss Blackburne.

PLATE LX. FIG. 3, 4.

Remarkable Coralline, *Ellis* in Phil. Trans. abridg. x. 345, pl. 8, fig. *a A.-G. Ellis* Corall. 35, pl. 19.—Sertularia neritina, *Lin.* Syst. 1315. *D. Chiaie* Anim. s. vert. Nap. iv. 147. *Esper* Sert. tab. 13, fig. 1-3.—Cellularia neritina, *Pall.* Elench. 67. *Flem.* Brit. Anim. 539.—Cellaria neritina, *Ellis* and *Soland.* Zooph. 22. *Lam.* Anim. s. vert. 2de édit. ii. 190.—Acamarchis neritina, *Lamour.* Corall. 58, pl. 3. fig. 2. *Risso* L'Europ. merid. v. 318. *Blainv.* Actin. 459, pl. 77, fig. 3.

Hab. On the English coast, rare. "I possess a specimen from the collection of the late Dr. Walker, which he received from Miss Blackburne from the coast of Cheshire," *Fleming.* Scarborough, very rare, *W. Bean.* Tynemouth, *Miss Ellen Forster.* Dredged from thirty-five fathoms, Copinstra, *Lieut. W. L. Thomas, R.N.*

Polypidom several inches in height, or growing in confervoid spreading tufts, almost membranous, of a white or brownish colour, bushy, dichotomously divided, the segments narrow-linear, subcylindrical, composed of a double series of semialternating cells divided by a waved septum; cells contiguous throughout, oblong, elongate, with smooth semitransparent parietes, truncate above, the outer angle projecting into a very short spine; aperture large, oval, with a smooth margin: ovarian capsules pearly, subsessile, globular, or rather formed like the young shells of a Nerite, for which they were at one time mistaken by Ellis.

Polypidoms are occasionally to be found without a single nerite-like operculum upon them. The branches of these are more slender than the fruitful specimens.

Cellularia neritina is recorded as an Irish species on the authority of Mr. Templeton, who is said to have found it in Belfast Lough and in Dublin Bay. Loudon's Mag. Nat. Hist. ix. 469. The

species intended, Mr. W. Thompson informs me, is C. avicularia. "This, with a few other trivial errors in Mr. Templeton's catalogues, is entirely attributable to their being posthumous publications. With respect to the present, for instance, the name 'Cellaria neritina' was hastily written with a *pencil* at the top of the page on which the specimens are fastened, but at the bottom the correct name 'Cell. avicularia' was written in ink as the one to be retained." *W. Thompson.*

8. C. plumosa, *cells linear-oblong, with a spine at the outer and upper angle; the aperture elliptical, entire.* Doody.

Plate LXI. Fig. 1—5.

Corallina pumila erecta ramosior, *Raii* Syn. i. 37, no. 20, tab. 2, fig. 1. *Ellis* in Phil. Trans. abridg. x. 346, pl. 8, fig. *b. B.-D.*—Soft feathered Coralline, *Ellis* Corall. 33, no. 1, pl. 18, fig. *a. A.*—Sertularia fastigiata, *Lin.* Syst. 1314. *Fabric.* Faun. Grœnl. 445. *Berk.* Syn. i. 219.—Cellularia plumosa, *Pall.* Elench. 66. *Couch* Corn. Faun. iii. 128, pl. 23, fig. 4.—Cellularia fastigiata, *Blumenb.* Man. 273. *Flem.* Brit. Anim. 539.—Cellaria plumosa, *Ellis* and *Soland.* Zooph. 21. *Lam.* An. s. Vert. 2de édit. ii. 120.—Crisia plumosa, *Lamour.* Corall. 62.—Crisia fastigiata, *Templeton* in Mag. Nat. Hist. ix. 468.—Bicellaria plumosa, *Blainv.* Actinolog. 459.

Hab.—"Not uncommon beyond low water-mark," *Fleming.*

Polypidom attached by fibrous roots, subcalcareous, caulescent, erect, from two to four inches high, very much branched, the branches panicled, dichotomous, with linear or filiform segments; cells oblong with a short pointed spine on the superior outer angle, smooth, pellucid or somewhat crystalline, marked always with a black or orange-coloured dot near the centre, the remains of the dried polype; ovarian capsules pearly, globular or pear-shaped, placed over the apertures.

In habit this fine species is sometimes like Sertularia argentea, but in general it is more tufted and bushy. Specimens occur without an ovary on any cell, while others are loaded with them; and in one of the latter sort I found some of the segments of the branches composed of a triple series of cells. The whole polypidom is usually coloured of a pink or purplish hue. In an old condition the cells become obsolete, and the habit of the species so altered, as to render its detection in this guise somewhat difficult to the inexperienced.

I have divided the Cellulariæ into sections which seem to be of generic value, but I am not sufficiently acquainted with the struc-

ture of the apertures in living specimens to justify an attempt, on my part, to characterize them. Dr. Fleming's name *Tricellaria* might be applied to the first section, but it would convey a false idea of the structure of one of the species: *Scrupocellaria* is applied by Van Beneden to the second section, but a barbarous name that violates every canon of nomenclature ought to be rejected: when the third section is named and defined generically, Flustra avicularis and murrayana will require to be removed to the genus: and *Acamarchis* of Lamouroux remains for the species of the fourth section.

16. Flustra,* Linnæus.

Character.—*Polypidom plant-like, membranous, frondose or crustaceous, formed of cells arranged quincuncially in several series and in one or two layers: cells in juxtaposition, more or less quadrangular, flat, with a distinct border; the aperture transverse, semilunar, valvular, subterminal.*†

* Foliaceous, with cells on both sides.

1. F. foliacea, *cells narrow at the proximal and arched at the distal extremity, with scattered marginal denticles.*

Plate LXII. Fig. 1, 2.

Fucus marinus scruposus albidus telam sericeam texturâ suâ æmulans, *Morris.* Hist. Plant. iii. 646, tab. 8, fig. 16. (bona.)—Fucus telam lineam sericeamve texturâ suâ æmulans, *Raii* Syn. 42, no. 9. *Jussieu* in Mem. Acad. Roy. des Sc. 1742, 298, pl. 10, fig. 3.—Broad-leaved Hornwrack, *Ellis* Corall. 70, no. 2, pl. 29, fig. *a*, *A*. *B*, *b*.—Curious sea-weed, *Hooke* Microg. 140, pl. 9, fig. 2; and pl. 14, fig. 1.—Eschara foliacea, *Lin.* Syst. edit. 10, 804. *Pall.* Elench. 52.—Flustra foliacea, *Lin.* Syst. 1300. *Mull.* Zool. Dan. prod. 253. *Ellis* and *Soland.* Zooph. 12, pl. 2, fig. 8. *Esper* Pflanz. Flust. tab. 1, fig. 1, 2. *Van Beneden* Recherch. 56, pl. 7, fig. 11-17. *Berk.* Syn. i. 214. *Lam.* Anim. s. vert. ii. 156: 2de édit. ii. 219. *Grant* in Edin. New Phil. Journ. iii. 111 and 337. *Flem.* Brit. Anim. 535. *Johnston* in Trans. Newc. Soc. ii. 263. Mag. Nat. Hist. iii. 483, fig. 120. *Tem-*

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* From the Saxon *Flustrian*, to weave: hence Flustra applied by Linnæus to these *sea-mats*.

† "The aperture of the cells is formed by a semicircular lid, convex externally and concave internally, which folds down when the polypus is about to advance from the cell. The opening of this lid in the F. truncata, where it is very long, appears through the microscope like the opening of a snake's jaws, and the organs by which this motion is effected are not perceptible. The lid of the cells opens and shuts in Flustræ, without the slightest perceptible synchronous motion of the Polypi." *Grant* in Edin. New. Phil. Journ. iii. 339.

pleton in Ibid. ix. 469. *Risso* L'Europ. merid. v. 333. *Blainv.* Actinolog. 450, pl. 75, fig. 1. *Couch* Zooph. Cornw. 53: Corn. Faun. iii. 121, pl. 21, fig. 1.

Hab.—Common on hard ground, in a few fathoms water. Professor Forbes gave me a specimen from the "Society Islands."

Polypidom corneous, frondose, arising from a spreading base with a single plane of cells, about four inches high, of a uniform wood-brown colour, thickish, deeply divided into numerous broad segments generally somewhat narrowed at their origin, often bifid or trifid, sometimes palmate near the apex which is slightly rounded; the surface roughish, minutely reticulated: cells small, in semialternating rows, narrow at the base, dilated and arched at the top, the superior margin armed with four stout conical processes shorter than the diameter of the cell. Wall of the cell thin and membranous, the orifice for the polype transverse, even, and somewhat labiate. The top of the cells is sometimes covered with a small hollow globular pearly operculum opening downwards.—The segments vary very much in breadth, but are rarely, if ever, proliferous. "Varietas vulgatior frondibus latiusculis, dilatatis, extremitate lata laciniosa. Rarior frondibus longis atque angustis. Perrara extremis frondium angustiorum latis et palmatis. Rarissima subpinnatis aut latissimis margineque tantum divisis frondibus." *Pallas.*—Hooke, in his celebrated "Micrographia," says, "for curiosity and beauty, I have not among all the plants or vegetables I have yet observed, seen any one comparable to this sea-weed." When recent it exhales a pleasant scent, which Pallas compares to that of the orange, Dr. Grant to that of violets, and which a friend tells me smells to him like a mixture of the odour of roses and geranium. On the contrary, Mr. Patterson tells me that the smell is strong, peculiar, and disagreeable. It probably varies, and is often not to be perceived at all.

2. F. CHARTACEA, *cells oblong, slightly enlarged distally; margins with a short spine at each junction with the adjacent cells.*

PLATE LX. FIG. 5, 6.

Eschara papyracea utrinque cellefera, summitatibus securis aciei instar truncatis, *Ellis* Corall. pl. 38, fig. 8.—Flustra papyracea, *Ellis* and *Soland.* Zooph. 13. *Flem.* Brit. Anim. 535. *Lister* in Phil. Trans. an. 1834, 384, pl. 12, fig. 3. *Edwards* in Lam. Anim. s. vert. 2de édit. ii. 220.—F. chartacea, *Turt.* Gmel. iv. 663. *Turt.* Brit. Faun. 209. *Stew.* Elem. ii. 436. *Couch* Corn. Faun. iii. 121.

Hab.—Coast of Sussex, *Ellis.* Brighton, *Lister.* Dublin bay, *Prof. Allman.* Southern coast of Ireland, *W. Thompson.*

"The cells of this sea-mat are of an oblong square figure, swelling out a little in the middle of each side. The openings of the cells are defended by a helmet-like figure; from hence the polype-shaped suckers extend themselves. This sea-mat is of a slender and delicate texture, like thin semitransparent paper, of a very light straw colour.—It was first found on the coast of Sussex, adhering to a shell. I have since met, on the same coast, about Hastings, in the year 1765, with several specimens, whose tops were digitated, and others that were very irregularly divided." *Ellis.*

Grows in small bushy tufts about an inch or little more in height, the fronds dilating, very much divided dichotomously, the segments spreading, rather narrow, expanded usually at the summit, and either truncate or rounded. Cells oblong, truncate at both ends, slightly dilated in the middle, with a small spine on the septa at the place of junction with the adjacent cells. Wall of the cell very thin and diaphanous, the polype-aperture small and unarmed, covered above with a helmet-shaped operculum.—The texture, compared with the preceding, is thin, and the surface is often glistening as if covered with a varnish. Sometimes it is partially tinted with pink. More nearly allied to Flustra truncata than to F. foliacea, but evidently a distinct species. Miss Howard informs me that it is common at Hastings.

As this is very certainly distinct from the F. papyracea of Linnæus, I have preferred the name of Gmelin.

3. F. TRUNCATA, *cells linear-oblong, with smooth margins.*

PLATE LXII. Fig. 3, 4.

Fucus marinus scruposus albidus augustior compressus, extremitatibus quasi abscissis, *Raii* Syn. 43, no. 10. *Morris.* Hist. Plant. Oxon. iii. 546, tab. 1, fig. 17, opt.—Narrow-leaved Hornwrack, *Ellis* Corall. 69, no. 1, tab. 28, fig. 1, *a. A, B.*—Eschara foliacea *β*, *Lin.* Syst. edit. 10, 804.—E. securifrons, *Pall.* Elench. 56.—Flustra truncata, *Lin.* Syst. 1300. *Mull.* Zool. Dan. prod. 253. *Ellis* and *Soland.* Zooph. 11. *Berk.* Syn. i. 214. *Esper* Pflanz. Flust. tab. 3, fig. 1, 2. *Oliv.* Zool. Adriat. 274. *Lam.* Anim. s. vert. 2de édit. ii. 219. *Grant.* in loc. cit. 111. *Flem.* Brit. Anim. 535. *Johnston* in Trans. Newc. Soc. ii. 264, pl. 12, fig. 1. *Templeton* in Mag. Nat. Hist. ix. 469.

Hab.—In deep water. Very common on the shores of Scotland, and of the north of England. In the south it seems to be rare, and is not included in the Cornish Fauna of Couch. Miss Howard writes that it never occurs, as far as she knows, at Hastings; nor has Dr. Mackness ever seen it there. In Ireland the species is local. "In Templeton's collection are specimens from Dublin Bay. It is common in Belfast Bay," *W. Thompson.*

Attains a height of four or five inches, very bushy, of a straw-colour, smooth, varnished when dry, rather thin in texture, originating from a matted base formed of capillary fibres, which, by their union, compose a short stem that divides, after a dichotomous manner, into numerous flat narrowish segments, either linear or dilated upwards. From the edges of these there often sprout out wedge-shaped leaflets, affixed by a small pedicle, simple at first, but afterwards deeply bifid : the ends of all the segments are abruptly truncate. Cells linear-oblong, their septa unarmed, usually marked with a black dot towards the centre, which seems to be the remains of the shrivelled polype, and at some seasons covered with a hood-like operculum. Wall of the cell thin and hyaline, with a small circular galeated aperture.

The *Porus cervinus minor* of Marsilli, Hist. Phys. de la Mer, p. 63, pl. vi. figs. 23, 24, is surely identical with Flustra truncata.

* * Foliaceous, with cells on one side only.

4. F. CARBASEA, *cells oblong, narrowed and truncate below, the margin toothless.* Dr. Skene.

PLATE LXIII. FIG. 1, 2.

Porus cervinus, *Mars.* Hist. Phys. de la Mer. 64, pl. 6, fig. 25, 26.—Eschara papyrea, *Pall.* Zooph. 56.—Flustra carbasea, *Ellis* and *Soland.* Zooph. 14. pl. 3, fig. 6, 7. *Turt.* Gmel. iv. 663. *Jameson* in Wern. Mem. i. 563. *Turt.* Brit. Faun. 209. *Stew.* Elem. ii. 436. *Lam.* Anim. s. vert. 2de édit. ii. 221. *Flem.* Brit. Anim. 535. *Grant* in Edin. New Phil. Journ. iii. 111. *Johnston* in Trans. Newc. Soc. ii. 264, pl. 9, fig. 4. *Templeton* ut sup. cit. 469. *Roget* Bridgew. Treat. i. 165, fig. 63, 64 ; and 172, fig. 69, 70. *Dalyell* in Edin. New Phil. Journ. xvii. 413 ; and in Rep. Brit. Assoc. an. 1834, 603.—Flustra papyracea, *Esper* Pflanz. Flust. tab. 2, fig. 1-3.

Hab.—On shells from deep water. From Aberdeen, *Skene.* Leith shore, *Mr. Parsons.* Not unfrequent at Seaton, Hartlepool, Whitburn, and other places on the coast of Durham, *J. Hogg.* Coast of Berwickshire, not uncommon, *G. J.* Coast at Bootle, rare, *Mr. Tudor.* Ireland, *Templeton.* Of rare occurrence on the Dublin coast, and I have never met with it elsewhere, *W. M'Calla.*

Polypidom frondose, fixed by a small disk, narrow at the base with thickened margins, dilating upwards and becoming very broad in proportion to the height, which at most is about two inches, thin, yellowish-brown, deeply divided, the segments broad and somewhat rounded on the apex. Cells on one side only, large, and smooth.

Polypes with about 22 tentacula, which are "nearly a third of the length of the body, and there appear to be about 50 ciliæ on each side of a tentaculum, making 2200 ciliæ on each polypus. In this species there are more than 18 cells in a square line, or 1800 in a square inch of surface, and the branches of an ordinary specimen present about 10 square inches of surface; so than a common specimen of the F. carbasea presents more than 18,000 polypi, 396,000 tentacula, and 39,600,000 ciliæ." *Grant.*

5. F. SETACEA, *cells in two or three rows, oval, with a setaceous bristle.* Rev. Dr. Fleming.

Flustra Ellisii, *Fleming* in Wern. Mem. ii. 251, pl. 17, fig. 1-3.—F. setacea, *Flem.* Brit. Anim. 536.

Hab.—"Along with Cellepora cervicornis, from deep water, Zetland," *Dr. Fleming.*

"Height nearly two inches; branches linear, not the tenth of an inch in diameter; substance firm, brittle; the base consists of small tubes, which, by their union, form the branches, dorsally carinated by the union of the tubes, which, diverging to each side and dividing, form two denticles and a long bristle, the latter serrated on one side; cells oblique." *Dr. Fleming.*

6. F. AVICULARIS, *cells in four or five rows, oblong, with a strong conical spine at each side of the aperture.* Ellis.

PLATE LXIII. FIG. 3, 4.

Corallina cum appendiculis lateralibus avium capitum formâ, *Ellis* Corall. pl. 58, fig. 7. —Cellularia avicularia β, *Pall.* Elench. 68.—Flustra avicularis *Sowerby* Brit. Misc. ii. 21, pl. 71. *Flem.* Brit. Anim. 536. *Johnston* in Trans. Newc. Soc. ii. 265. *Blainv.* Actinolog. 451. *Couch* Zooph. Cornw. 54: Corn. Faun. iii. 122.—F. angustiloba, *Lam.* Anim. s. vert. ii. 158. 2de édit. ii. 222.—F. capitata, *Hogg's* Stock. 36.—Crisia flustroides, *Lamour.* Corall. Flex. 141.

Hab. Attached to other corallines and old shells in deep water.

Usually about an inch in height, cæspitose and fan-like, or spread out circularly, of a cinereous colour, membrano-calcareous, brittle when dry, deeply divided in a dichotomous manner into narrow thin plane segments, truncate at the end, formed of four or five series of oblong cells, capped with a hollow globose pearly capsule seated between the spines, of which there is one on each side of the circular aperture. The ovarian capsules are so numerous that they give to the upper surface the appearance of being thickly strewn with orient

pearls : the under surface is even and longitudinally striated, the number of striæ corresponding to the number of rows in which the cells are disposed.

7. F. MURRAYANA, *cells multiserial, ovate, the margin armed with six or eight spines shorter than the diameter of the cell.* Mr. Bean.

PLATE LXIII. FIG. 5, 6.

Flustra Murrayana, *Bean*, MSS. named "after Dr. Murray, a scientific and zealous naturalist of Scarborough."

Hab. In deep water. Scarborough, very rare, *Mr. Bean.* Coast of Northumberland, *Miss Dale.* Coast of Yorkshire and Orkney Island, I believe common in deep water, *Lieut. Thomas, R.N.*, from whom I have some fine specimens. Zetland, *E. Forbes.* "I obtained a number of specimens of this rare species in deep water on the Dublin coast. It occurred in different situations attached to Plumularia falcata, or to the base of Flustra foliacea, but its most favourite place is in dead bivalves, particularly of Mytili ; where sheltered from the action of the sea it spreads out into a beautiful tuft, attached by a very slender base. My specimens were of a dark brown colour, and I am convinced that this is the natural colour of all specimens obtained in a living state." *W. M'Calla.*

This pretty species grows in entangled spreading masses which are rooted to the object of attachment by numerous long thread-like tubular fibres, wrinkled when dry, and apparently always pullulating from the side or inferior surface of a marginal cell. Polypidom scarcely an inch in height, of a light colour and thin membranous texture, dichotomous, spreading, the segments plane, narrow wedge-shaped, truncate, the upper surface roughish with the cells, which are disposed in the usual quincuncial manner, but are more elevated than in any other species ; the under surface glistening, striate : cells unilateral, so large that their figure is perceptible to the naked eye, ovate, truncate above with a short hollow spinule at each angle, and there are from four to six rather longer spinules protecting the margin of the elliptical aperture.

The species is very distinct from any hitherto described ; but I suspect that the *Sertularia spiralis* of Olivi (Zool. Adriat. 291, tab. 6, fig. 2.) may prove to be the same thing. It is nearly allied to Flustra avicularis, and, like this, is often loaded with the "Bird's-head" appendages.

* * * Crustaceous.

8. F. MEMBRANACEA, *cells oblong, with a short blunt spine at each corner.* Ellis.

PLATE LXVI. FIG. 1, 2, 3.

Flustra membranacea, *Lin.* Syst. 1301. *Fabric.* Faun. Groenl. 437. *Mull.* Zool. Dan. prod. 253. *Ellis* and *Soland.* Zooph. 18. *Flem.* Brit. Anim. 536. *Johnston* in Trans. Newc. Soc. ii. 265. *Blainv.* Actinol. 450. *Couch* Zooph. Corn. 55 : Corn. Faun. iii. 123, pl. 21, fig. 2.—Fl. telacea, *Lam.* Anim. s. vert. 2de édit. ii. 223. *Grant* in loc. s. cit. iii. 111.—Membranipora membranacea, *Blainv.* Actinol. 447.

Hab. On the fronds of the Laminariæ and Fucoideæ, common.

Polypidom forming a gauze-like incrustation on the frond of the sea-weed, spreading irregularly to the extent of several square inches, in general thin and closely adherent, but sometimes becoming thickish, and then capable of being detached in considerable portions; cells very obvious to the naked eye, oblong, quadrangular with a blunt hollow spine at each angle. In many specimens there are some anomalous processes, a quarter of an inch in height, scattered over the surface: they arise from within the cells, are simple, horny and tubular, but closed at top. Ellis conjectured they were ovaries, and the conjecture is rendered probable by the recent observations of Mr. Couch.—When the polypes are all protruded they form a beautiful object under the microscope, from their numbers, their delicacy, the regularity of their disposition, and the vivacity of their motions, now expanding their tentacula into a beautiful campanulate figure, now contracting the circle, and ever and anon retreating within the shelter of their cells. The tentacula are numerous, filiform, white, and in a single series.

The Rev. David Landsborough has seen a specimen (and I have seen its equal) of F. membranacea five feet in length by eight inches in breadth. "As every little cell had been inhabited by a living polype, by counting the cells on a square inch, I calculated that this web of silvery lace had been the work and the habitation of above two millions of industrious, and, we doubt not, happy inmates; so that this single colony on a submarine island was about equal in number to the population of Scotland." Scott. Christ. Herald for April 1840, p. 244.

9. F. CORIACEA, *cells broadly elliptical, coriaceous, with*

smooth septa ; the aperture small, semilunar, with an even rim. E. Forbes.

PLATE LVI. FIG. 8.

Flustra coriacea, *Esper* Pflanz. Flust. Tab. vii. fig. 2.

Hab. Encrusting old shells. On Pecten opercularis, Isle of Man, *E. Forbes.* On stones from Fowey harbour, *C. W. Peach.* On shells dredged off Sana Island by *G. C. Hyndman.*

This species forms a thin greyish-white crust, closely adherent to its base, and about the size of a sixpence but capable of enlargement to an indefinite extent, with the cells large enough to be visible to the naked eye: the cells are broadly elliptical but the figure encroached upon behind, contiguous, quincuncial, coriaceous, the walls smooth when wetted, when dried they were somewhat granulous and sunk, the septa smooth and a little raised, the aperture small, subterminal, semilunar, (the upper or proximal margin being straight and transverse,) surrounded with a plain even rim. On most of the cells there are two hollow tubercles at the aperture, one on each of its posterior angles.

The figure of Esper is a very good one, but he represents the aperture as being circular, which was not the case in our specimens.

10. F.? LINEATA, *cells oval, separate, the margin hispid with a series of short spines, erect or bent inward.* Professor Jameson.

PLATE LXVI. FIG. 4.

Flustra lineata, *Lin.* Syst. 1301. *Mull.* Zool. Dan. prod. 253. *Fabric.* Faun. Grœnl. 437. *Jameson* in Wern. Mem. i. 563. *Couch* Zooph. Cornw. 55: Corn. Faun. iii. 124. *W. Thompson* in Ann. Nat. Hist. v. 253.—Flustra spinifera, *Johnston* in Trans. Newc. Soc. ii. 266, pl. 9, fig. 6.—Fl. hirta, *Lamour.* Corall. 49. *Bosc* Vers, iii. 144. *Risso* L'Europ. Merid. v. 334.

Hab. On rocks, old shells, and on sea-weeds near low-water mark, common.

Polypidom membranous, closely-adherent, spreading irregularly, sometimes in circular patches, of a horny texture and yellowish-brown colour ; the cells just visible to the naked eye, more or less contiguous, oval or oblong, the margins ciliated with short spines that bend across the open upper surface. There is often a small pearly ovarian capsule over the aperture.

Linnæus has described this species well, and his description is rendered complete by Otho Fabricius, who correctly says,—" Impres-

sura osculi amplitudinem fere totius cellulæ habet, et ciliæ 8 vel 10 ab utroque latere conniventes aperturam fere claudunt."

I am inclined to believe that Flustra lineata is not a species but a state of a Lepralia, sometimes of L. nitida, sometimes of L. ciliata, or of annulata, and perhaps of some others. The objection to this conclusion is that it is found abundantly in situations where all these Lepraliæ are rare. Mr. Peach is decidedly of opinion that it is a good species. "I have found it," he writes me, "from its earliest state to old age and it invariably presents the same appearance as other corallines do in their progress through their various stages of development:—first thin pearly transparent, and then thickening and more opaque until old,—then the ribs thickened and more dull. It is more ridged in the centre, and the ribs do not touch, as in Lepralia nitida. In fact each may be clearly observed distinct in every stage."

What have been described under the names of *Flustra distans* (*A. Hassall* in Ann. Nat. Hist. vii. 369), and specimens which I have named to some of my correspondents *Flustra fallax*, (Plate LVII, Figs. 11 & 12.) are merely states of Lepraliæ and Membraniporæ. It is often difficult, however, to refer the imperfect specimens to their true species.

Flustra arenosa, *Ellis* and *Soland.* Zooph. 17. *Stew.* Elem. ii. 437. *Bosc* Vers, iii. 142.—Millepora arenosa anglica, *Raii* Syn. i. 31.—English Sandy Millepore, *Ellis* Corall. 74, no. 5, pl. 25, fig. e.—Eschara lutosa, *Pall.* Elench. 37.—Alcyonium arenosum, *Turt.* Gmel. iv. 564. *Turt.* Brit. Faun. 207.—According to Mr. Boys this "is undoubtedly the nidus of some marine animal, as I have found the cells entire, with eggs in each." Lin. Trans. v. 231. Mr. J. Hogg has proved that it is the nidus of Nerita monilifera. Lin. Trans. xiv. 318, &c.

17. Eschara,* Ray.

Character.—*Polypidom membrano-calcareous, inflexible, brittle, expanding in the form of foliaceous porous lamellæ, variously folded and anastomosing, and consisting of two layers of opposite cells: Cells immersed, coalescent, horizontal to the plane of axis, opening on both surfaces in quincuncial pores protected with an operculum.*

1. E. foliacea, *plates foliaceous, winding, uniting irregu-*

* Εσχαρα, the scar from a burn.

larly, and forming sinous cavities ; cells oval or rhomboidal, the aperture level with the surface or sunk, ovate, with a straight lip. Dillenius.

Plate LXVII.

Eschara retiformis, *Raii* Syn. 1, 31. *Flem.* Brit. Anim. 531—Stony foliaceous Coralline, *Ellis* Corall. 71, no. 3, pl. 30, fig. *a*, *A*, *B*, *C*. *Borl.* Cornw. 239, pl. 24, fig. 6.—Eschara fascialis, *Pall.* Elench. 44.—Millepora fascialis, *Lin.* Syst. 1283. *Oliv.* Zool. Adriat. 223. *Stew.* Elem. ii. 427.—Millepora foliacea, *Ellis* and *Soland.* Zooph. 133.—Cellepora lamellosa, *Esper* Cellep. p. 146, tab. 6. fig. 1-5.—Eschara foliacea, *Lam.* An. s. Vert. ii, 174 : 2de édit. ii. 266. *Blainv.* Actinol. 428, pl. 75, fig. 3. *Milne-Edwards* in Ann. des Sc. Nat. vi. 36, pl. 3, fig. 1. Mem. 34, pl. 3, fig. 1. *Couch* Zooph. Corn. 60 : Corn. Faun. iii. 131.

Hab. On various parts of the English coast in deep water. "Conchis testisve adnascitur et circa Cockbush in Sussexiâ sæpe reperitur," *Dillenius.* Isle of Wight, *Ellis.* Cornwall, *Borlase.* Devonshire, *Dr. Coldstream.*

This curious polypidom attains a large size, being often three or four inches high, and from twelve to twenty in its greatest diameter. Mr. Couch has seen a specimen which "measured seven feet four inches in circumference, and a foot and three quarters in depth." It may be described as a broad membrane twisted into winding folds, leaving large sinuosities and cavernous interstices : it is very light and floats in water, crisp when dry, but when living "slightly elastic," membrano-calcareous, cellular, of a yellowish-brown colour, roughish, and punctured with the numerous cells which open on both sides. The membrane is less than a line in thickness, and consists of two layers of cells separated behind from one another by a thin plate down the middle. The cells open obliquely by contracted roundish apertures disposed in a quincunx order on the surface, and which, more especially when recently formed, are often covered by a small operculum. They are liable to some changes of form from age, but are normally of an oval or rhomboidal figure with a round or semi-oval aperture that does not project above the surface. The wall of the cells is wrinkled but not porous.

"Besides this foliaceous or plaited form, there is another, not noticed by authors ; an encrusting form which resembles the *Flustra bullata* of Linnæus. This is found encrusting stones and forming its cells like a *Flustra,* in large circumscribed patches. The first appearance of its rising into a lamellated form, is the production of detached ridges and papillary eminences, as these become more elevated they assume the form described above." *Couch.*

From the description I conclude that the *Flustra foliacea* of Mantell's "Wonders of Geology," p. 466, is the Eschara foliacea just described.

2. E. fascialis, "*expansions narrow, compressed, branched, occasionally united.*" Pallas.

Italian Coral, *Ellis* Corall. 72, pl. xxx. fig. *b*.—Eschara fascialis var. *a*. *Pall*. Elench. 42. *Lam*. Anim. s. Vert. ii. 175: 2de édit. ii. 267. *Flem*. Brit. Anim. 531.—Millepora tænialis, *Ellis* and *Soland*. Zooph. 133.—M. fascialis *Berk*. Syn. i. 211. *Turt*. Br. Faun. 204.—Cellepora ligulata, *Esper* Cellep. 146, tab. 8, fig. 1, 2.—L'Eschare à bandelettes, *Blainv*. Actinolog. 428. *Milne-Edwards* in Ann. des Sc. Nat. Part. Zool. vi. 43, pl. 4, fig. 1.

Hab. Deep water. Isle of Wight, *Pallas*.

"This Millepore grows in very irregular masses, but always preserves the same habit of growing; that is, the branches are flat, narrow, and regularly subdivided: they coalesce, twist, and branch out again, leaving certain hollow spaces between them; their cells are much smaller, though of the same shape with the cells in the foliaceous Millepore" (E. foliacea). *Solander*.—Pallas maintains that it is merely a variety of the preceding; but Milne-Edwards thinks it ought to be retained distinct, for its peculiarity of ramification, and the narrowness of the divisions, do not depend on age, and seem to indicate a specifical difference. The cells in both species are alike.

3. E. cribaria, *erect, the laminæ broad and foliaceous; cells punctured, oval or rhomboidal, the aperture of the mature ones with a mucro projecting in front.*

Plate LX. Fig. 7—9.

Hab. Brought up, with other corallines, from a depth of about thirty-five fathoms in Berwick Bay.

Polypidom arising from a crustaceous circular base, erect, frondose, expanding into broad undulated and sinuous lobes, consisting of a double layer of cells and about a line in thickness. Surface even, porous, variously marked. The cells exhibit themselves under three phases. The young or immature cells are small, rhomboid, closely packed, arranged quincuncially, with thick opaque walls that are coarsely punctulated, the aperture minute, round, and generally inconspicuous. Where these cells are found the surface of the polypidom is smooth comparatively, but other parts of the surface are punctured like a thimble with round depressed holes, and the space

between them is punctulated. Other parts are rough, from a short mucro that projects over the mouth of the cells, and these are probably the mature and perfect cells. Height of specimen, three-fourths of an inch ; breadth, nearly the same.

I cannot refer this to any species described by Milne-Edwards in his monograph of the genus. It approaches nearest to E. porosa.

I have seen fragments of other two native species of Eschara—one from Scarborough in the collection of Mr. Bean, and another from Zetland which was sent to me by Professor E. Forbes; but they were too imperfect to be described with the minuteness that is necessary in so difficult a genus.

18. Retepora,* Lamarck.

Character.—*Coral foliaceous, stony, fragile, netted; cells opening only on the upper or inner side, short and not prominent.*

1. R. reticulata, *polypidom latticed, wavy and convolute, the upper side warty and very porous.* Rev. William Borlase.

Millepora retepora, *Borl.* Cornw. 240, pl. 24, fig. 8.—Millepora reticulata, *Lin.* Syst. 1284. *Fabric.* Faun. Grœnl. 433. *Ellis* and *Soland.* Zooph. 138. *Esper* Pflanz. tab. 2, fig. 1-5. *Oliv.* Zool. Adriat. 223.—M. frondipora, *Pall.* Elench. 241.—Retepora reticulata, *Lam.* Anim. s. Vert. ii. 182 : 2de édit. ii. 275. *Risso* L'Europ. Mérid. v. 343. *Flem.* Brit. Anim. 531. *Stark* Elem. ii. 435. *Blainv.* Actinolog. 633. *Couch* Corn. Faun. iii. 130.—Frondipora reticulata, *Blainv.* Ibid. 406, pl. 69, fig. 1.

Hab. Deep water, rare. Cornwall, *Borlase.*

"Expanding to the extent of two or three inches; more or less cup-shaped, waved, uniting; the lobes are oval, regular, the intervening spaces supporting two or three pores in oblique rows. This species is very distinct from the R. cellulosa, with which it has been confounded." *Fleming.*

2. R. beaniana, *polypidom umbilicate, funnel-shaped, wavy, celluliferous on the inner side, the interspaces unarmed.* Ellis.

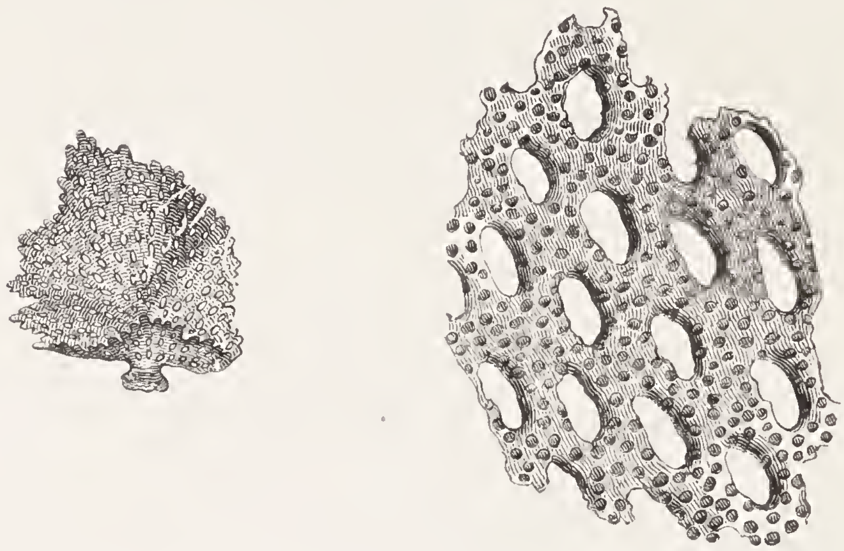
Millepora cellulosa, *Jameson* in Wern. Mem. i. 560. *Turt.* Brit. Faun. 205. *Stew.* Elem. ii. 427.—Millepora foraminosa, *Ellis* and *Soland.* Zooph. 138, pl. 26, fig. 2. —Retepora cellulosa, *Johnston* in Loudon's Mag. Nat. Hist. vii. 638, fig. 69. *S. V. Wood* in Ann. and Mag. N. Hist. xiii. 16. *W. Thompson* in Ibid. xv. 322.— Retepora Beaniana, *King* in Ann. and Mag. N. Hist. xviii. 237.

Hab. Deep water, rare. "Though this elegant little coral is found now and then on our coast, we cannot boast of those beautiful

* From *rete* and πορος, *i. e.* "a porous net-work."

forms that we find in specimens from the Mediterranean Sea," *Ellis.* Shetland Islands, and in the island of Fulah, *Jameson.* Scarborough, *W. Bean.* Cape Clear, Ireland, *Prof. Allman.* Orkneys, *E. Forbes.* Deep water off the coast of Northumberland, *W. King.*

Fig. 67.



Polypidom about an inch in height, affixed by a hollow, thick, and very short stalk, which expands into a shallow cup with unequal waved and sinuous margins; pure white, calcareous, and beautifully reticulated, the meshes about a line in length, oval, subequal, regular, and divided by celluliferous spaces, rather wider than their own shortest diameter; the cells immersed, quincuncial, leaning with the apertures looking upwards, a little prominent, round, with a small tooth on the distal edge; they open only on the superior or inner aspect, for the under surface of the polypidom is imperforate and almost smooth.

"Dr. Johnston and others have considered this coral to be identical with the Mediterranean Retepora cellulosa; but, after an examination of the characters of each, I have been led to conclude that they are distinct species. In the Mediterranean coral the interstices of the celliferous surface are furnished with strong hook-shaped processes curving upwards—generally two on each side of a mesh, but nothing of the kind is seen in the British species; and the under lip of the cell-apertures is not provided like the latter with a tubular process. Further, Retepora cellulosa has the meshes generally wider than the interstices; in R. beaniana they are not so wide. These differences are not the result of age, as they prevail in old and young specimens of both species; probably there may be other differences, which can only be detected by a powerful microscope. In other re-

spects, the British coral seems to be closely related to the one living in the Mediterranean." *W. King.*

19. Salicornaria,* Cuvier.

Character.—*Polypidoms plant-like, calcareous, dichotomous; the branches cylindrical, regularly jointed, with immersed rhomboidal cells diverging from the axis, disposed in quincunx, and opening on the surface; the aperture lateral, transverse, somewhat labiate.*

1. S. farciminoides, *cells rhomboidal, the aperture central.*

Plate LXVI. Fig. 6, 7.

Corallina fistulosa fragilis, *Raii* Hist. i. 65.—Corallina fistulosa fragilis, internodiis prælongis lævibus, albis, farciminum modo catenatis, *Pluken.* Phytog. pl. 26, fig. 2. —Bugle Coralline, *Ellis* Corall. 46, no. 1, pl. 23, fig. *a*, *A*, *B*, *C.*—Eschara fistulosa, *Lin.* Syst. edit. 10. 804.—Cellularia Salicornia, *Pall.* Elench. 61.—Tubularia fistulosa, *Lin.* Syst. 1302. *Oliv.* Zool. Adriat. 267. *Berk.* Syn. i. 214.—Cellaria farciminoides, *Ellis* and *Soland.* Zooph. 26.—Isis hippuris, *Fabr.* Faun. Groenl. 427.—Cellaria Salicornia, *Lam.* An. s. Vert. ii. 135: and 2de édit. ii. 176. *Bosc* Vers. iii. 129, pl. 28, fig. 6. *Lamour.* Exposit. Méthod. 5: Corall. 55. *Blainv.* Actinolog. 455, pl. 77, fig. 1.—Salicorniaires, *Cuv.* Reg. Anim. iii. 303.—Salicornaria dichotoma, *Schweig.* Handb. 428.—Salicorniaria fistulosa, *Templeton* in Mag. N. Hist. ix. 469.—Farcimia fistulosa, *Flem.* Brit. Anim. 534. *Johnston* in Trans. Newc. Soc. ii. 266.—Cellaria fistulosa, *S. V. Wood* in Ann. and Mag. N. Hist. xiii. 17.—Farcimia salicornia, *Johns.* Brit. Zooph. 295, pl. 37, fig. 6, 7. *Couch* Zooph. Cornw. 58: Corn. Faun. 129, pl. 20, fig. 3.

Hab. On corallines and old shells from deep water, not uncommon. "Is of frequent occurrence on the Dublin coast, where it is found in dense masses attached to oysters and other substances in deep water. With regard to Mr. Hassall's Farcimia sinuosa, I think it is nothing more than a very common variety of Salicornia. I have observed a considerable difference in the size of the cylinders, but this often occurs in the same individual. At Carrickfergus, on the Antrim coast, the zoophyte assumes a very singular habit: it is found in great abundance, but of very small size, parasitical on Desmarestia aculeata; consequently the joints in this case were small to suit their position on the slender fronds of the Desmarestia, and each individual consisted of from one to three joints." *W. M'Colla.*

One of the finest of British zoophytes. Polypidom from one to

* *Salicornaria,*—formed from *Salicornia*, a salt-marsh plant which the zoophyte resembles in external habit. Lamouroux appropriated the name *Cellaria* to this group, and Blainville has followed him. Cuvier gave it the name *Salicornaria* in 1817; and it was adopted by Schweigger in 1820. In 1828 Dr. Fleming called the genus *Farcimia.*

three inches high, white, calcareous, fibrous at the base, erect, regularly dichotomous; branches erecto-patent, straight; joints constricted, often blackish and emitting fibrous radicals; the intervening spaces long, cylindrical, frequently swollen near the upper end, covered all round with lozenge-shaped immersed cells, disposed in quincunx, and radiating from the centre.

In a weak mixture of muriatic acid and water, the calcareous portion of the polypidom is entirely removed, without any other alteration in its form and structure; and we learn from the experiment that the joints are connected together by capillary corneous tubes, equal in number to the series of cells. These tubes cannot be traced through the immediate spaces, but, from the circumstance of their being hollow, it seems not unreasonable to infer that they may naturally be filled with an irritable pulp, and be the medium of communication between the cells and polypes of the different interspaces. The branches are not tubulous or fistular, as Blainville has properly remarked; whence the impropriety of the Linnæan trivial name, the retention of which only tends to the perpetuation of error.

Under this species Pallas has the following interesting observation:—"Celerrime hanc *Cellulariam* crescere, saltem celerius embryone Squali, docuerunt ova Squali Promontorio merid. Africes allata, in quibus plantulas plures semipollicares observavi, quanquam fœtum adhuc immaturum continerent."

2. S. sinuosa, *cells oblong or spathulate; the aperture semilunar, situated in the upper third of each cell.*

Plate LXVI. Fig. 8.

Ellis Corall. 47, pl. 23, fig. *D*.—Tubularia fistulosa, *Esper* Tubul. tab. 2, fig. 1-4.—Farcimia sinuosa, *Hassall* in Ann. and Mag. N. Hist. vi. 172, pl. 6, fig. 1, 2. *Macgillivray* in Ibid. ix. 468.—Farcimia spathulosa, *Hassall* in Ibid. xi. 112.

Hab. In deep water, or in the coralline region, often intermixed with the preceding species.

"I have but little hesitation in pronouncing this to be a new species. It differs from the ordinary species in the greater size of the cylinders, in the shape of the cells (too material to be the result of any accidental circumstances), and, above all, in the position of the aperture, which in this is placed in the upper part of each cell, while in *F. salicornia* it is exactly central. This last I consider to be the most important distinction of all. The number of the cells on each cylinder is also much greater than in the preceding species." *A. H Hassall.*

At a subsequent period Mr. Hassall states, that, on a careful re-examination of his specimens, he had in no case found other than rhomboidal cells in *S. farciminioides*, or spathulate or modified spathulate cells in *S. sinuosa ;* and my own experience tends to corroborate Mr. Hassall's opinion. Nevertheless the real specific distinctness of the species is undetermined. "The shape of the cells," says Ellis, "is not always of a lozenge figure : sometimes we find them arched at top, and sometimes of the shape of a coffin." But the evidence here is not conclusive, for Ellis may have found these differently shaped cells on different specimens. Mr. Macgillivray, however, states that he has found them all on one polypidom. He says, "By a careful examination of a very fine specimen selected from an extensive series, I have found a great variation in the form of the cells. These are generally 'rounded above and excavated below for the reception of the head of the succeeding cell,' as they are described by Mr. Hassall, but between this form and a perfect rhomboid there exists an obvious gradation. Rhomboidal cells are found chiefly upon the terminal articulations, but occur also throughout the polypidom along with the much more numerous spathulate cells. In Mr. Hassall's specimens the aperture was invariably 'situated in the upper third of each cell ;' in mine, however, the aperture is occasionally 'exactly central ;' it often commences at the middle of the cell, although still more frequently at a little above this."—Mr. Couch is another authoritative witness to the same effect. After mentioning the variations in size to which the polypidom is subject, he adds,—"The cells also are liable to considerable variations, not only in different specimens, but in different parts of the same. Thus, those cells at the inferior portion of the branches are quadrangular most commonly, while at the upper parts the superior angle is expanded into an arch, and hence resembles the cells of Flustra foliacea. It would almost seem as if there were two species confounded under this name ; but, although they differ so much in size, I have been unable to discover any specific distinctions between them. The cells can offer no guide in determining this point, as they vary so much in the same specimen."

Heteropora septosa, "polypidom boletiform, irregular, sometimes investing ; pores irregular," *S. V. Wood*, in Ann. and Mag. N. Hist. xiii. 14.—Mr. Wood remarks of his fossil specimen of this zoophyte, that it "corresponds with a recent British species in my possession upon an Arca lactea."—I do not know the species.

III. HALCYONELLEA.

POLYZOA CARNOSA, *J. E. Gray* in Syn. Brit. Mus. 135 (1842).—Alcyoniadæ, *Johnston* in Trans. Berw. Nat. Club, i. 108 (1836).—Alcyonidulæ, *Johns.* Brit. Zooph. 300.

20. ALCYONIDIUM,* Lamouroux.

CHARACTER.—*Polypidom fleshy, variously lobed; cells immersed, pentagonal, with fibro-corneous parietes; the aperture terminal, simple, contractile.*†—*Polypes ascidian, with a double sheath.*

1. A. GELATINOSUM, *polypidom variously lobed or branched, subcylindrical or somewhat compressed, the surface smooth and even.* Johnson.‡

PLATE LXVIII. FIG. 1—3.

Fucus spongiosus nodosus, *Ger.* Herb. emac. 1570, no. 10, fig. *Raii* Syn. i. 49, no. 42.—Alcyonium, seu fucus nodosus et spongiosus, *Ellis* Corall. 87, no. 5, pl. 32, fig. *d*, *D*.—Alcyonium ramosum molle, multis polypis obsessum, *Bast.* Opusc. Subs. i. 40, tab. 1, fig. 5, *A*, *B*.—Alcyonium gelatinosum, *Pall.* Elench. 353. *Lin.* Syst. 1295. *Oliv.* Zool. Adriat. 240. *Esper* Pflanz. tab. 18, *A*, fig. 1, 2. *Müll.* Zool. Dan. Prod. 255. Zool. Dan. iv. 30, tab. 147. *Ellis* and *Soland.* Zooph. 176. *Jameson* in Wern. Mem. i. 563. *Stew.* Elem. ii. 432. *Flem.* Brit. Anim. 517. *Lamour.* Cor. Flex. 350. *Blainv.* Actinolog. 525, pl. 92, fig. 1.—Ulva diaphana, Eng. Bot. pl. 263. *With.* Bot. Arrang. iv. 121. *Hull* Brit. Fl. ii. 312. *Lam.* and *Decand.* Flor. Franç. ii. 6.—Alcyonidium diaphanum, *Lamour.* Soland. Zooph. 71. *Gray* Brit. Pl. i. 353. *Hook.* Fl. Scot. ii. 75. *Loud.* Encycl. Pl. 928, no. 15045.—Al. flavescens, *Loud.* Encyclop. Pl. 928, no. 15046.—Halodactylus diaphanus, *Farre* in Phil. Trans. an. 1837, 405, pl. 25 and 26. *Van Beneden* Recherch. 60, pl. 8, fig. 12.—Alcyonidium gelatinosum, *Johns.* Br. Zooph. 300, pl. 41, fig. 1-3. *Couch* Corn. Faun. 132. *W. Thompson* in Ann. Nat. Hist. v. 253. *Hassall* in Ann. and Mag. N. Hist. vii. 370.

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* From *Alcyonium*, to which the name implies a resemblance.

† According to Dr. Farre, the retractile portion of the cell, or that which constitutes the base of the polype, is composed of a series of stout short setæ.

‡ Thom. Johnson. "He was born near Hull, in Yorkshire, bred an apothecary in London, and afterwards lived and kept a shop on Snow-hill; where by his unwearied pains, advanced with good natural parts, he attained to be the best herbalist of his age in England." He was created M.B. in 1642, and on May 9th 1643 M. D. Oxon. at which time he was "a Lieutenant-Col. in the garrison of Basing-House in Hampshire, whence going with a party, on the 14th of September 1644, to succour certain of the forces belonging to that house which went to the town of Basing to fetch provisions thence, but beaten back by the enemy, (headed by that notorious rebel, Col. Rich. Norton,) he received a shot in his shoulder, whereby contracting a fever, he died in a fortnight after in the said house: at which time his worth did justly challenge funeral tears, being then no less eminent in the garrison for his valour and conduct as a soldier, than famous through the kingdom for his excellency as an herbalist and physician." *Wood's* Fast. Oxon. p. 39.

Hab. Deep water, attached to old shells and stones.

The polypidom is attached by a narrow base to the substance from which it grows, and rises to the height of from six to twelve inches, "sometimes attaining the length of two or three feet." It resembles a compact sponge, but is more pellucid and gelatinous ; sometimes simple and entire, usually branched, and in an irregular and multifarious manner : the colour, as is well observed in "English Botany," varying from a very pale brown, almost like that of wet sea-sand, to a clear yellow ; in the latter case the polypidom has exactly the appearance of barley-sugar of the paler kind. The surface is smooth and speckled with minute dots produced by the dark bodies of the inhabitant polypes, which protrude their tentacula through the angular apertures, and are all placed immediately underneath the skin, for the centre of the polypidom is a clear transparent jelly traversed with corneous fibres, forming a very wide and irregular net-work. The polypes are so intimately connected with their cells, that it is almost impossible to remove them without mutilation. They have sixteen filiform tentacula, disposed in a single circle, which are capable of being retracted within the cell. "The tentacula are sixteen in number, (occasionally fifteen,) fully two-thirds the length of the body of the animal, and extremely slender and flexible. When expanded they are frequently seen to roll up closely upon themselves, even down to their base, the revolution taking place either inwardly or outwardly, and in one or more arms at the same time. Their full expansion affords a more perfect campanulate form than is usually met with in this class, each of the arms having a slight curve outwards towards its extremity, which gives to the whole a very elegant appearance. It is remarkable that in some specimens the arms are much shorter on one side of the body than on the other." *Farre.*

"The stomach is not furnished with a gizzard in this species. The intestine forms a considerable elbow at its origin, and is short and wide, terminating not as in other cases near the tentacular ring, but about midway up the body, at a point opposite the base of the setæ.

"A very singular organ was frequently observed, consisting of a little flask-shaped body situated between the base of two of the arms, and attached to the tentacular ring by a short peduncle. The cavity in its interior is lined with cilia which vibrate downwards towards the outer, and upwards towards the inner side ; it has a narrow neck and a wide mouth, around which a row of delicate cilia are constantly playing. No flow of fluids could ever be detected through it, nor did the use of carmine assist in showing with what parts the

cavity in its interior might communicate. From the circumstance that it is more frequently absent than present, it cannot be an organ of vital importance to the animal; and it is too intimately blended with the sides of the tentacula, and too constant in its position, to be regarded as a parasite. Does it indicate a difference of sex?" *Farre.*

This production was first described by Johnson, the editor of "Gerarde's Herbal." His description, which is characteristic enough, is as follows:—"This is a very succulent and fungous plant, of the thicknesse of one's thumbe; it is of a dark yellowish colour, and buncheth forth on everie side with many unequal tuberosities or knots; whereupon Mr. Thomas Hickes, being in our companie, did fitly name it Sea Ragged Staffe."—It was afterwards observed on the southern coasts of England by Dale and Doody; and Ray introduced it into his "Synopsis of British Plants" as a fucus. Ellis at first suspected it to be the spawn of some shell-fish, but (whether relying on the authority of Pallas, who had seen the polypes, or upon subsequent original observations, is uncertain) he ultimately came to a correct conclusion, for, in his "History of Zoophytes," he says, "This is found at particular seasons full of minute papillæ which send forth polypes." The fact was overlooked; and, on the authority of Ray and Hudson, botanists continued to rank it in the vegetable kingdom, where it remained until very recently. Even Lamouroux considered it at first as a sea-weed, but he had the fortune afterwards to detect the polypes, which he describes as having a cylindrical body and twelve tentacula, and the description which Dr. Fleming has given is essentially the same. If no error has crept into their calculation, the species must be distinct from ours, for a very careful examination has satisfied me that the tentacula are sixteen in number.

D'Orbigny says that the *Ulva diaphana* of the "Flore Française" "n'est autre chose qu'un amas de séries d'œufs d'une espèce de gastéropode nu." Mém. du Museum, vi. 181. The description, however, so evidently belongs to the Alcyonidium before us, as to make it almost certain that this remark has originated in some misapprehension.

2. A. HIRSUTUM, *polypidom variously divided, compressed; the surface covered with minute conical papillæ or polype-cells.* Fleming.

PLATE LXIX. FIG. 1, 2.

Alcyonium gelatinosum, *Fabric.* Faun. Grœnl. 447. *Esper* Pflanz. Alcyon. tab. 18, fig. 1.—A. hirstuum, *Flem.* Brit. Anim. 517. *Johnston* in Zool. Journ. iv. 418;

and in Trans. Newc. Soc. ii. 251, pl. 9, fig. 1.—Alcyonidium hirsutum, *Johns.* Brit. Zooph. 303, pl. 42, fig. 1, 2. *Hassall* in Ann. and Mag. N. Hist. vii. 370, pl. 10, fig. 3, 4. *Couch* Corn. Faun. iii. 133.—Halodactyle velu, *Van Beneden* Recherch. 61, pl. 8, fig. 3-8.

Hab. Parasitical on various sea-weeds at low water-mark, common.

Polypidom variously divided, often proliferous, sometimes sub-cylindrical, commonly flattened and palmate, of a dirty straw-yellow colour, often partially stained with red, and marked with numerous yellowish circular spots irregularly disposed. It is thickish, somewhat cartilaginous, and to the naked eye resembles a compact sponge. When viewed through a common magnifier, the surface is seen to be covered with close-set conical transparent papillæ, each of which is a cell containing a polype with sixteen long filiform tentacula, and in its structure resembling the polype of a Flustra. The yellowish spots, mentioned in the description, are produced by clusters of ova lying embedded in the cellular texture. These are opaque, milk-white, large enough to be easily visible to the eye, of a roundish figure, but not all of them alike, for some are ovate, and others incline to a heart-shape, rather compressed, the surface uneven. The egg is clothed with cilia, of equal size and shape, and all inclined in one direction, moving with a uniformity and quickness which is admirable and very pleasing to the beholder. When the egg is at rest, their velocity is not diminished, excepting at the will, so to speak, of the ovum, for it may be seen to become slower and less constant, to cease entirely for a moment, and again be renewed with its former force. The egg at rest will at once start from its place, and swim about hither and thither as it were endowed with volition, turning on its axis frequently, moving sometimes on one side, sometimes on its edge, when the cilia become invisible. I have seen the cilia, when the ovum was at rest, suddenly disappear, withdrawn as it seemed within themselves, and again be quickly protruded. By their motion they drive a current of water over the surface; but this current has certainly not an uninterrupted circular motion—it is rather a flowing to the surface, and a current from it, or, as Raspail would express it, an inspiration and expiration of water. When lying still, I have seen the eggs exhibit the most unequivocal signs of irritability, contracting and dilating themselves. The ovum appears to be formed of a firm elastic coat or shell filled with a granular matter.

The *Spongia damicornis* of Esper, Pflanz. Spong. tab. 63, is apparently the Alcyonidium hirsutum.

3. A. PARASITICUM, *incrusting corallines, earthy, the surface even and porous.* Rev. Dr. Fleming.

PLATE LXVIII. FIG. 4, 5.

Alcyonium parasiticum, *Flem.* Brit. Anim. 518.—Alcyonidium parasiticum, *Johns.* Brit. Zooph. 304, pl. 41, fig. 4, 5. *Couch* Corn. Faun. iii. 134. *Hassall* in Ann. and Mag. N. Hist. vii. 370. *Reid* in Ann. and Mag. Nat. Hist. xvi. 393.—Halodactyle parasite, *Van Beneden* Recherch. 62, pl. 8, fig. 9-12.

Hab. Parasitical on Sertulariadæ.

This production spreads up the stem and branches of various flexible corallines, coating them with an incrustation of an earthy appearance, from a line to the eighth of an inch in thickness. The surface is porous or cellular, even, roughish, the pores roundish or pentagonal, distinct and separate, but not arranged in rows, or in any regular fashion; the interior is irregularly cellular, and earthy.—None of the mineral acids have any effect on this substance, nor does it absorb water like a sponge, but when dropped into a glass of water, it sinks to the bottom, and lies there unaltered. No siliceous nor calcareous spicula enter into its structure, but it seems to be entirely composed of particles of sand cemented together with mud or clay.

Considerable doubts were entertained of the nature of this unattractive production, which have been entirely removed by the researches of Mr. Hassall, Van Beneden, and Professor Reid. The best account of the polypes is given by the last naturalist. They have fifteen or, as Mr. Hassall says, sixteen tentacula, nearly of the length of that part of the animal which protrudes beyond the cell, and these are ciliated. "Before the animal protrudes itself it pushes up from the interior of the cell a short tube of the form of a truncated cone. From the orifice of this tube several hairs or very fine bristles project. This tube next becomes still more elongated; and this elongation is evidently effected, not by its continued protrusion, but by the unfolding of a part which had been previously bent inwards. When this takes place the hairs or bristles are now seen to be attached to the edge of the opening in this tube, instead of protruding out of its interior. These bristles are connected at their base by a fine membrane; and, if I am not mistaken, the tube itself is composed of similar bristles connected together by a membrane. This tube is translucent, and the tentacula are seen within it. The neck of the polype projects, when the animal protrudes itself, to a considerable extent. The mouth is rounded, is surrounded by the tentacula, and opens into a very wide cavity (pharynx). On breaking up some of

the cells under the microscope, I obtained a view of several of the polypes, but not so perfectly as I would wish. The stomach is lined by a layer of yellowish granules, and the cilia extend downwards along the intestinal canal, but to what extent I was not able to determine. I observed some in active motion, in one fragment, in the rectum. The pharynx and œsophagus are seen frequently to contract and dilate when the animal is protruded. A number of small oval brownish bodies adhere to the cells. These are full of granules, and I suppose them to be ova. I placed a small portion of the polypidom in aqua potassæ about two hours ago, and on looking at it with a simple lens, the cells have become translucent, retain their form entire, and present the appearance of being calcareous. I suspect, therefore, that these cells are formed of a mixture of animal and calcareous matter." *John Reid.*

The Alcyonidium subviride of Couch's Corn. Faun. iii. 133, is the *Geodia zetlandica* described in my History of British Sponges.

I shall here notice a species that may be referred to the genus Alcyonidium with as much propriety as to the genus Flustra,* where it has been usually placed. It is the

Flustra hispida, *Fabric.* Faun. Grœnl. 438. *Jameson* in Wern. Mem. i. 563. *Flem.* Brit. Anim. 537. *Johnston* in Trans. Newc. Soc. ii. 266, pl. 9, fig. 7. *Blainv.* Actinol. 450.—Flustra spongiosa, *Templeton* in Loud. Mag. N. Hist. ix. 469. *W. Thompson* in Ann. Nat. Hist. v. 253.—Membranipora spongiosa, *Johns.* Brit. Zooph. 282.—Flustra carnosa, *Johns.* Brit. Zooph. 288, pl. 37, fig. 5. *Couch* Corn. Faun. iii. 125. *Hassall* in Ann. and Mag. N. Hist. vii. 369.

Plate LXVI. Fig. 5.

It is found investing Fucus serratus, and is common on our coast near low-water mark. When recent the crust is about a line in thickness, fleshy, brown, with scattered spinules appearing on the surface, which is otherwise smooth and glistening. When dried, it appears like a wrinkled hirsute membrane, adhering very closely to the seaweed. The cells are inconspicuous, but it can be perceived that they are arranged quincuncially, and have a lunate aperture, armed with about five long rigid bristles. The polypes, according to Dr. Fleming, have "an enlarged head, and from twenty to thirty tentacula." In a beautiful figure given by Mr. Hassall in Ann. and Mag. N. Hist. vii. pl. 6, fig. 1, under the name of *Coryne squamata*, the polypes are represented with eighteen tentacula; but, in his de-

* This species, which is undoubtedly no *Flustra*, ought to be raised to a generic rank, and placed in the family Alcyonidulæ." *A. H. Hassall.*

scription of the species, he says that he has constantly found the number to be thirty.

21. Cycloum,* Hassall.

Character.—" *Polypidom fleshy, encrusting, covered with numerous imperforate papillæ. Polypi ascidian ; ova in clusters.*" Hassall.

1. C. papillosum. A. H. Hassall.

Plate LXX.

Cycloum papillosum, *Hassall* in Ann. and Mag. N. Hist. vii. 483.

Hab. Parasitical on Fucus serratus.

" This species is almost invariably found investing the frond of Fucus serratus, over the surface of which it spreads in patches of from one to two inches in extent, more frequently of one, and seldom exceeding two inches. The crust is fleshy, and rather thick: it is covered with numerous papillæ very closely set together. The polypi do not issue from these papillæ, which are imperforate, but from larger eminences of irregular form and size, in the centre of which a puckered depression is seen. The polypi have eighteen tentacula, describing a cup or bell. The ova lie in clusters, each cluster containing six or seven ova arranged in a circle. The clusters are irregularly scattered through the polypidom, and each is inclosed in a space somewhat larger than is sufficient to contain it, the remainder of the space being occupied by a fluid in which numerous small particles are seen, which are kept in constant action by the motion of the cilia on the ova. Each ovum is of a circular form, but is depressed, one side more so than the other : round its edge a fringe of cilia is apparent ; these may be seen in motion long before the ova are ready for becoming disengaged. I have discovered in this, as well as in the succeeding and some other genera, a body of a very peculiar nature, but concerning the uses of which I can at present only hazard some conjectures. It is, in this species, and in Alcyonidium gelatinosum and hirsutum, in which I have also met with it, of an oblong form, and composed of a transparent matter, in which numerous small dark brown granules, circular in shape and not unlike ova, are imbedded. I at first imagined that they were nothing more than particles of lime lodged in a soft jelly-like sub-

* From κυκλος, a circle, and ὠον, an egg; in reference to the arrangement of the ova.

stance, but this opinion was disproved by the application of hydrochloric acid, which did not cause effervescence. These bodies are far more numerous than the ova, and are not more than one-tenth their size. The most probable conjecture which I have been able to form as to their nature is, that they are organs destined to contain the ova until they have arrived at a certain degree of maturity, in fact, ovaries, and if not ovaries, the ova themselves in a very early stage of their formation.

"I have been induced to raise this species to a generic rank, principally from the arrangement of the ova in circles, which is, I believe, peculiar to it. Some weeks ago, when at Belfast, Mr. Thompson pointed out this species to my notice, saying, at the same time, that he had forwarded it long since to Dr. Johnston as new; its distinctive characters had, however, been made out by myself long previous to this interview with Mr. Thompson, and reference is made to it in my Catalogue.*

"This zoophyte, as well as the succeeding species, exhibits in a very remarkable degree that 'close adhesion to life,' the usual accompaniment of a low organization, which renders this class of animals so patient of injuries which would be fatal to beings of greater complexity of structure. I have on more than one occasion seen the polypidoms of this and the following species enveloped in a firm coating of ice; on immersion of either of these in sea-water the coating has become dissolved, and the polypi have protruded their feelers, and have appeared as active as though they had never been exposed to such a very low degree of temperature as would have destroyed the life of more highly organized animals. From this it is apparent that their sensibility cannot be very great." *A. H. Hassall.*

22. Sarcochitum,† Hassall.

Character.—"*Polypidom encrusting, fleshy, covered with numerous prominences of irregular form and unequal size, from which the polypi issue; ova circular, scattered singly throughout the polypidom; a dark brown body of a circular form, filled with small round granules, is apparent in great numbers through the polypidom. Polypi ascidian.*" Hassall.

1. S. polyoum. A. H. Hassall.

* Published in the "Annals" for Nov. 1840, p. 170.

† From σαρξ, flesh, and χιτων, a coat or crust.

Plate LXXI.

Sarcochitum polyoum, *Hassall* in Ann. and Mag. N. Hist. vii. 484.

Hab. Parasitical on Fucus serratus.

"This species is also usually found investing Fucus serratus, the frond of which it sometimes covers to the extent of several inches. The crust is thin and fleshy, and covered with numerous large eminences of irregular form and unequal size, which exhibit a puckered appearance in the centre, and from which the polypi issue; these have twenty tentacula. The polypidom, when found on one side of the weed, is generally also present on the reverse side; and this is somewhat curious, as the crust almost constantly terminates on each side of the weed at some distance from its edge, so that it cannot reach the one side from the other by a continuity of growth.

"The ova in this species are exceedingly numerous, and vary in colour from white to yellow; they present much the same form and appearance as those of the preceding genus. If a quantity of the sea-weed, with the zoophyte upon it, be placed in salt-water for a few hours, great numbers of the ova will become liberated, and may plainly be seen with the unassisted eye moving about in almost ceaseless action; now gliding rapidly along the surface of the water, now wheeling round upon their axes; at one time elevating themselves in the fluid, again as rapidly sinking in it—these elevations and subsidences seeming to depend upon the form of the ovum, which is seen to change with these movements. The facility and rapidity with which these little bodies seem to perform their evolutions is very striking. They may often be seen to run along the water in a straight line for several inches, at a pace which would far outstrip the fleetest Newmarket racer—the relative sizes of the two creatures being taken into consideration; and it is not a little curious to observe, that, no matter how many ova be moving about in the same space, still they never come in contact, appearing to avoid each other as carefully as though they were possessed of eyes.

"The thought then occurred to me, that the minute, frail, and delicate ova of these species must have made their way unscathed and uninjured through from twenty to thirty miles of the troubled and stormy ocean, and have fixed themselves to our rocks—the vibratile cilia on their surfaces being mainly instrumental in effecting their transportation.

"The polypidoms of this and the preceding species are often so mixed up in their distribution upon the same piece of sea-weed, that

it requires a practised eye to distinguish them. I have been induced to consider this species as distinct from the genus Alcyonidium, to which it bears a near relation, for the following reasons:—1st. The number of the tentacula, a character which I have found to be constant, it being twenty in this and but sixteen in Alcyonidium; 2nd. This species never rises from the surface of attachment in the form of an independent polypidom—it is invariably encrusting, whereas all the species of the genus Alcyonidium do form elevated polypidoms; and 3rd. There is a difference in the form of the body or organ to which I have referred in the description of the genus Cycloum, it being circular in this, while it is oblong in the genus Alcyonidium.

"I have frequently noticed a species of zoophyte lining the interior of old shells of Buccinum undatum, and covering the under surface of stones, which I consider to be identical with this. If a portion of the polypidom of this species, in a living condition, be suddenly plunged into spirits, an instantaneous protrusion of the polypi takes place, having their feelers arranged, as in life, in the form of a graceful bell. In this state they may be kept, for a time, for the purposes of future examination. The cause of this protrusion is readily explained. The polypes being already contracted within their cells, on the application of the irritating spirit are compelled to start outwards,—the only motion of which they are capable when folded up within these cells." *A. H. Hassall.*

IV. VESICULARINA.

Polyzoa cornea, *J. E. Gray* in Syn. Brit. Mus. 135.

FAMILY—VESICULARIADÆ.

Since we profess to be guided, in the classification of zoophytes, by similarity in the structure of the polypes considered independently of their polypidoms, the Vesiculariadæ, notwithstanding their apparent dissimilarity, must be associated in the same order with Alcyonidium and Flustra. They have been hitherto united with the Sertulariadæ; and, previous to our knowledge of their polypes, this seemed a very natural union, for the polypidoms of both are slender and plant-like, horny, fistular, and flexible, and furnished with somewhat similar cells on their branches. But the differences between them even in outward aspect are not inconsiderable; and, although it may be difficult to point out these by any description,

they are nevertheless not the less obvious to one familiar with the objects. The polypidoms of the Vesiculariadæ are more flexible and of a thinner texture, less arboreal and more confervoid, not so regularly jointed, nor ramified in the same determinate and fixed manner. They are all marine productions, generally not more than an inch or two high, and are found attached only to sea-weeds or other corallines.

For a knowledge of the animated tenants of these structures we are indebted to Cavolini, the Rev. Dr. Fleming, J. V. Thompson, Esq., and more particularly to Dr. Farre,* of whose researches a summary has been given in the preliminary observations. The following is his description of the cells in the present family:—

"The transparent horny cell, which closely embraces the body of the animal, is nearly unyielding in its lower two-thirds, but terminates above by a flexible portion, which serves to protect the upper part of the body when the whole is expanded, in which state it is of the same diameter as the rest of the cell; but when the animal retracts is folded up and drawn in after it, and completely closes the mouth of the cell.

"The flexible part consists of two portions, the lower half being a simple continuation of the rest of the cell; the upper consisting of a row of delicate bristle-shaped processes or setæ, which are arranged parallel with each other round the top of the cell, and are prevented separating beyond a certain distance by a membrane of excessive tenuity, which surrounds and connects the whole. This mode of termination of the cell is one of constant occurrence, as will be described in other species, and is evidently a provision for allowing of the freest possible motion of the upper part of the body in its expanded state, to which it affords at the same time support and protection." Phil. Trans. an. 1837, p. 393.

23. Serialaria,† Lamarck.

Character.—*Polypidom confervoid, horny, the shoots slender, filiform, fistular, and branched; cells tubulous, uniserial and unilateral, disposed in close parallel companies at stated intervals; polypes ascidian.*

1. S. lendigera, *much branched, the branches spreading,*

* To these I have now to add Van Beneden, Hassall, and Professor John Reid.

† From *seriala*, a diminutive formed from *series*, a row.

subdichotomous ; cells in isolated groups, erect, with wide uneven apertures. Doody.

Fig. 68.

Fucoides lendigerum capillamentis Cuscutæ instar implexis, *Raii* Syn. 38, no. 3.—Nit Coralline, *Ellis* Corall. 27, no. 24, pl. 15, fig. *b*, *B*.—Sertularia lendigera, *Lin.* Syst. 1311. *Pall.* Elench. 124. *Ellis* and *Soland.* Zooph. 52. *Oliv.* Zool. Adriat. 289. *Esper* Pflanz. Sert. tab. 9, fig. 1, 2. *Turt.* Gmel. iv. 682. *Berk.* Syn. i. 218. *Stew.* Elem. ii. 445. Wern. Mem. i. 564. *Turt.* Brit. Faun. 215. *Bosc* Vers. iii. 117. *Hogg's* Stock. 33. *Lister* in Phil. Trans. an. 1834, 384.—La Sertolara lendinosa, *Cavol.* Polip. Mar. 229, tav. 9, fig. 1, 2. *D. Chiaie* Anim. s. vert. Nap. iv. 146.—Serialaria lendigera, *Lam.* Anim. s. vert. ii. 130 : 2de édit. ii. 169. *Risso* L'Europ. Merid. v. 315. *Flem.* Brit. Anim. 547. *Stark* Elem. ii. 439. *Templeton* in Mag. Nat. Hist. ix. 467. *Couch* Zooph. Cornw. 37. *Blainv.* Actinolog. 476, pl. 38, fig. 2. *Couch* Corn. Faun. iii. 94, pl. 16, fig. 4.—Amathia lendigera, *Lamour.* Cor. flex. 159. Expos. Method. p. 10. Corall. 68.

Hab. On Fuci near low-water mark, frequent on the shores of England and Ireland, and occurs also on many parts of the Scotch coast. Partial to Halidrys siliquosa as a base : occasionally on other zoophytes, as Gemmellaria loriculata, &c., *W. Thompson.*

" This extremely small climbing coralline arises from very minute tubes, by which it adheres to Fucuses and other marine bodies ; and is so disposed from its jointed shape, that it climbs up and runs over other corallines and Fucuses, as Dodder does over other plants." *Ellis.* The tufts thus formed resemble a flock of hair with clusters of nits scattered over it ; and although the comparison is an ugly one, it is

yet expressive. The filaments are capillary, smooth, pellucid, kneed and jointed at their dichotomies, immediately under which the cells are usually placed in a short row containing from four to eight or nine cells, growing gradually shorter outwards, and so arranged as to resemble a Pan's-pipe in miniature, "with cylindrical reeds varying in their length."—That the polypes are ascidian is satisfactorily proved by Cavolini; and Lister informs us that they have eight ciliated arms.

24. Vesicularia,* J. V. Thompson.

Character.—*Polypidom rooted, confervoid, fistular, horny, dichotomously branched, jointed at the divisions; cells ovate, disjunct, uniserial and unilateral. Polypes ascidian with eight tentacula, and a gizzard.*

1. V. spinosa. Dillenius.

Plate LXXII. Fig. 1—4.

Conferva marina cancellata, *Raii* Syn. i. 59, no. 11. *Dill.* Hist. Musc. 24, no. 22, pl. 4, fig. 22,—fide *D. Turner* in Lin. Trans. vii. 106.—Conferva cancellata, *Lin.* Syst. ii. 720. *With.* Bot. Arrang. iv. 131.—Silk Coralline, *Ellis* Corall. 20, no. 17, pl. 11, fig. *b*, *B*, *c*. *D*.—Sertularia spinosa, *Lin.* Syst. 1312. *Ellis* and *Soland.* Zooph. 48. *Turt.* Gmel. iv. 682. *Esper* Pflanz. Sert. tab. 28, fig. 1, 2, 3. *Jameson* in Wern. Mem. i. 564. *Bosc* Vers. iii. 118. *Berk.* Syn. i. 219. *Stew.* Elem. ii. 446. *Turt.* Brit. Faun. 215. *Lam.* Anim. s. Vert. ii. 120: 2de édit. ii. 148. *Hogg's* Stock. 33.—Sertularia sericea, *Pall.* Elench. 114.—Laomedea spinosa, *Lamour.* Corall. 91. *Blainv.* Actinolog. 474. *Templeton* in Mag. Nat. Hist. ix. 466.—Valkeria spinosa, *Flem.* Brit. Anim. 551. *Couch* Zooph. Cornw. 38.—Vesicularia spinosa, *Thomp.* Zool. Illust. 98, pl. 3, fig. 1-8. *Farre* in Phil. Trans. an. 1837, 401, pl. 22. *Johns.* Brit. Zooph. 250, pl. 29, fig. 1-4. *Hassall* in Ann. and Mag. N. Hist. vi. 170. *Van Beneden* les Bryozaires, 30, pl. 4, fig. *c*. *Couch* Corn. Faun. iii. 94, pl. 17, fig. 1.

Hab. "On oyster beds," *Fleming.* Generally distributed along the shores of Great Britain, but most abundant on the south and west coasts. Frequent on the shores of Ireland, and like all our zoophytes, attains a much greater than ordinary size on the Dublin coast, *W. Thompson.*

Polypidoms affixed by a fibrous base, very slender, confervoid, of a thin membranous pellucid texture, much branched, erect, sometimes as much as a foot in height, usually about four inches: main branches composed of intertwined capillary tubes, tapered, zigzag; branchlets arising from the bends, either solitary or in pairs, short,

* From *vesicula*, the diminutive of vesica, a bladder.

much divided dichotomously, the apices pointed and closed; all the branches are jointed under each bend, and the branchlets at each division, and they are perforated with a single series of rather distant holes with a raised rim, as if they had been bored from within outwards: cells three between each joint, deciduous, oval, transparent.—"The animals are very easily seen in all their details in this species, from the great transparency of the vesicles, and are provided with *eight* tentacula," *Thompson*, which "are ciliated but not armed with spines." *Farre.*

The holes in the sides of the capillary branches mark the places whence the polype-cells have fallen. The spine-like points in which the divisions of the branchlets terminate have suggested the Linnean specific name; and that of Ellis and Pallas expresses the silky appearance which dried specimens exhibit. Ellis has well marked the distinctions which separate the species from the Sertulariadæ. "The motion of the *intestines* of the young polypes was very distinguishable till the water became putrid; and then both *vesicles and polypes dropped off*, like blighted blossoms off a tree; and the substance of the parent polype, though seeming to fill the whole cavity of the branch before, as soon as the water became improper for its support, *shrivelled up immediately so as scarce to be visible.*"

25. Beania,* Johnston.

Character.—*Polypidom confervoid, horny, the shoots creeping, filiform, tubular, irregularly divided; the cells very large, sessile, erect, scattered and solitary, ovate with a double spinous keel on one side. Polypes unknown.*

* This remarkable genus was discovered by Mr. William Bean of Scarborough. I felt gratified in associating it with his name. He is well known to Naturalists generally by his multitudinous discoveries in British Zoology, recent and fossil. To some of his new species the trivial name *fabalis* has been applied, but the justice of such a conceit or puzzle is questionable, since it veils the discoverer's name from those who are not good guessers. Mr. Bean may literally address his native place in the words of Drayton,—

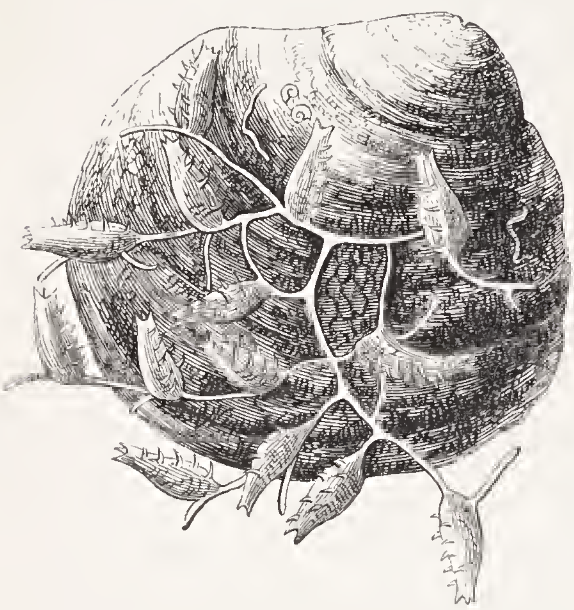
> "My Scarborough, which looks as though in heaven it stood,
> To those that lie below, from th' bay of Robin Hood,
> Even to the fall of Teis; let me but see the *man*,
> That in one tract can show the wonders that I can."
>
> Poly-olbion, Song 28.

1. B. mirabilis. W. Bean.

Beania mirabilis, *Johnston* in Ann. Nat. Hist., v. 272.

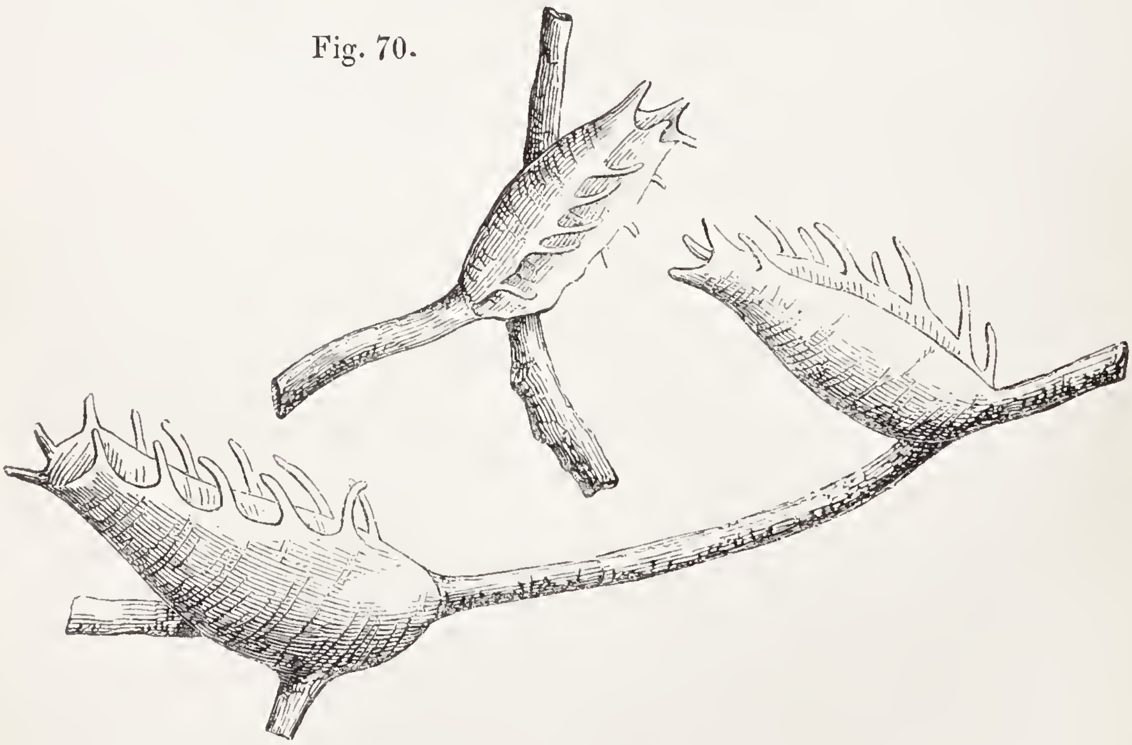
Hab. Parasitical on bivalve shells and rocks at or within low water-mark, or creeping among the roots of Cellularia avicularia. Scarborough, very rare, *W. Bean.* On an old valve of Pecten maximus dredged off Scilly, *Mr. Mac Andrew.* Attached to the surface of a cork (Crab-float), Bream sands, four miles west of Falmouth, *W. P. Cocks.*

Fig. 69.



The only specimens which I have seen of this very remarkable coralline are parasitical on bi-valved shells, that are likewise almost crusted over with two or three species of *Lepralia.* It is large enough to be easily seen with the naked eye, but of such minuteness that it may be readily passed over unnoticed, excepting by a naturalist of the practice and acuteness of its discoverer. The stalk creeps over the surface of the shell, to which it adheres loosely, and is divided at intervals without order or regularity,—the shoots form-

Fig. 70.



ing sometimes a long simple thread, while at other places they anastomose freely. The shoots are very slender, filiform, smooth, colour-

less and pellucid, tubular, unjointed, and horny; and in general they are slightly swollen at the origins of the cells. These appear to be rather seated on the tube than a development of it, though it is probable that there is a direct and free communication between them. The cells are scattered and always single, half a line in height, sessile, ovate, bulging below, horny, vesicular, slightly compressed, smooth, with a double keel down one side; and each keel is armed with from five to seven spinous teeth, which are placed sometimes nearly opposite, and in other instances alternately (Fig. 70). The aperture is quadrangular, terminal and wide, half closed with a thin membrane, and furnished at each angle with a spinous denticle.

Though the polypes are unknown, yet there can be little hesitation, from the structure of the polypidom, in foretelling their affinity to those of the family Vesiculariadæ.

26. Valkeria,* Fleming.

Character.—*Polypidoms confervoid, fistular, membranous and variously branched: cells clustered, ovate with a narrow base: "Polypes with eight regularly ciliated tentacula:" no gizzard.*

Obs. The animal of Valkeria differs from that of Vesicularia and Bowerbankia, "in the entire absence of the manducatory organ; a difference which it is of great importance to observe with reference to a natural arrangement of the class." *Farre.*

* "This genus is dedicated to the late Dr. Walker, Professor of Natural History in the University of Edinburgh, a laborious and an accomplished naturalist."—"The present compliment to his name may be deemed insignificant. Perhaps it is so; but I have been led to pay it, from having had an opportunity of judging of his intimate acquaintance with the tribe of Zoophytes to which this group belongs, by inspecting a collection of specimens of various species of Sertulariæ, which he had collected on the Scottish shores, and arranged and named. These have exhibited numerous proofs of his zeal, his knowledge, and his sagacity." *Fleming.* Sir J. E. Smith characterises him as "a most amiable, worthy, and ingenious man." Sir James visited Moffat in the autumn of 1782, of which parish Dr. W. was the minister. "I spent that day," he says, "and the next, very happily with the Doctor; he is a very agreeable man: the life and soul of Moffat; his loss will be equally felt by the gay, the industrious, and the unhappy,"—alluding to his approaching removal or translation to Collington, near Edinburgh. (In 1844 I visited Moffat, and, to my chagrin, I found not one inhabitant who remembered Dr. Walker.) His posthumous "Essays on Natural History," Edin. 1812, 8vo. is an interesting volume, which I have had occasion to regret was not more noticed in our Faunas and Floras.

1. V. cuscuta, *stem with subverticillate branches; cells clustered or in opposite pairs.* Ellis.

Climbing Dodder-like Coralline, *Ellis* Corall. 28, no. 26, pl. 14, fig. *c*, *C*.—Sertularia Cuscuta, *Lin.* Syst. 1311. *Pall.* Elench. 125. *Ellis* and *Soland.* Zooph. 53. *Berk.* Syn. i. 218. *Mull.* Zool. Dan. iii. 62, tab. 117, fig. 1-3. *Turt.* Gmel. iv. 680. *Turt.* Brit. Faun. 214. Wern. Mem. i. 564. *Bosc* Vers. iii. 113. *Stew.* Elem. ii. 444. *Fleming* in Wern. Mem. iv. 485, pl. 15, fig. 1.—Valkeria Cuscuta, *Flem.* Brit. Anim. 550. *Farre* in Phil. Trans. an. 1837, 402, pl. 23. *Hassall* in Ann. and Mag. N. Hist. vii. 286. Van Beneden les Bryozoair. 27, pl. 4, fig. *B*. *Couch* Corn. Faun. iii. 96, pl. 17, fig. 3.—Vesicularia Cuscuta, *Thomp.* Zool. Illust. 97, pl. 2, fig. 1-4.—Cuscutaria Cuscuta, *Blainv.* Actinol. 497, pl. 82, fig. 2.

Hab. Parasitical on littoral sea weeds. West coast of England, *Ellis.* Devonshire, *Mrs. Griffiths.* Fresh-water Bay, Isle of Wight, *W. Thompson.* Cornwall and Norfolk, *C. W. Peach.* In the Frith of Tay, *Fleming.* Leith shore, *Jameson.* Coast of Ayrshire, *D. Landsborough.* "This species, though little known, is by no means rare, and is met with around the Irish coast. It is found on various algæ in the loughs of Strangford and Belfast, but more particularly on Halidrys siliquosa, which superlatively bears the palm as favourite of the zoophytes," *W. Thompson.*

"The main stems originate from tubular creeping roots, which invest marine plants in shoal water: these stems are often jointed at unequal distances, and give off a number of short branches, which originate in pairs from its opposite sides, frequently just above a visible joint: these branches support the vesicles, which are scattered over their surface in an irregular manner, and do not differ except in size and number of tentacula, from those of V. imbricata: the tentacula being 8 in number." *J. V. Thompson.*—"Height seldom above two inches; several stems usually arise from the same base, filiform, jointed, waved, and support the branches and cells bifariously; branches opposite, nearly perpendicular to the stem, with a joint immediately above their insertion: cells oval, sessile, upwards of ten times the breadth of the stem, in pairs, at remote distances, projecting, and are probably ultimately converted into branches: sometimes they occur in pairs or crowds in the axillæ of the branches; polypi extend considerably beyond the margin, tentacula with hairs, which by their motions, cause the water to ascend in a current on one side, and descend on the other, acting, probably, as aërating organs." *Fleming.*

In the Zoologia Danica, Abildgaard gives the number of tentacula as twelve, but the figure and description is in other respects so appli-

cable to the zoophyte before us, that I concur with Dr. Fleming in thinking that some error must have been made in the enumeration of them.

I have hitherto said nothing of the phosphorescence of the Polyzoan zoophytes, yet several of them exhibit the phenomenon as vividly as any of the preceding orders. Valkeria cuscuta, Cellularia reptans, Flustra membranacea, and Membranipora pilosa are specifically mentioned by the Rev. D. Landsborough; and, like the similarly gifted Anthozoa, they emit their light only under peculiar circumstances, and under others cannot be made to do so. These circumstances are not correctly ascertained, but the life of the polype and the display of its light are not necessarily concurrent, for in one of Mr. Landsborough's experiments, when it is certain that all its polypes must have been dead, "Membranipora stellata lighted up just one bright star, and Flustra membranacea shed one faint gleam of light, and refused to repeat the fire, however much shaken." Ann. and Mag. N. Hist. viii., 259.—The light that proceeds from the Flustra membranacea, says Mr. Landsborough, is very beautiful, for as the cells are so closely and regularly arranged, it exhibits, when shaken, a simultaneous blaze, and becomes for a little like a sheet of fire. He continues,—"With Flustra pilosa I was very successful. That variety of it which is spread on a flat surface, and which, from the form that the polypidom assumes, is the Membranipora stellata of Thompson, on being bent or shaken, became doubly entitled to the name of *stellated*, for every polype in its cell lighted up a very brilliant little star, and for a short time the polypidom became like an illuminated city."

2. V. UVA, "*stem creeping, irregularly branched; cells scattered.*" Ellis.

Grape Coralline, *Ellis* Corall. 27, no. 25, pl. 15, fig. *c*, *C*, *D*.—Sertularia uva, *Lin.* Syst. 1311. *Ellis* and *Soland.* Zooph. 53. *Berk.* Syn. i. 218. *Turt.*. Gmel. iv. 682. *Turt.* Brit. Faun. 215. *Stew.* Elem. ii. 445. *Jameson* in Wern. Mem. i. 564. *Bosc* Vers. iii. 117. *Hogg's* Stock. 34.—Clytia uva, *Lamour.* Corall. 89. *Templeton* in Mag. Nat. Hist. ix. 466.—Valkeria uva, *Flem.* Brit. Anim. 551. *Couch* Zooph. Cornw. 38. *Hassall* in Ann. and Mag. N. Hist. vi. 170. *Couch* Corn. Faun. iii. 95, pl. 16, fig. 5.—La Campanulaire ovifere, *Blainv.* Actinolog. 473.

Hab. "Growing on Fucus's and other corallines, on the British coast," *Ellis.* Leith shore, *Jameson.* "Found on Fucus nodosus on the coast at Kirkcubbin, county Down, July 1806," *Templeton.* Coasts of Antrim and Down, *W. Thompson.* "Parasitical on the sea-oak (S. pumila), abundant about October," on the coast of Corn-

wall, *Couch.* On Fucus siliquosus, rare in Dublin Bay, *A. H. Hassall.*

"This exceeding small coralline creeps on the broad-leafed hornwrack" (Flustra foliacea); "and sends out clusters of vesicles from several parts of its creeping tube, each of which has a black spot in it, like the spawn of frogs: Or rather, these look when they are magnified, like a bunch of full ripe transparent oval-shaped grapes with the stones in them."—"Among many other marine substances received fresh from the sea, in September 1753, this object happened to present itself under my magnifying glasses; when, to my surprise, I found those grape-like bodies were a cluster of polypes, each having eight claws or tentacula, very lively, extending themselves about in pursuit of prey; and upon their dying, the animals contracted themselves into their vesicles, which closed at the top: What we discover as a spot, is only the intestines of the polype with its food in it." *Ellis.*

"This species climbs over fuci and corallines by means of its horny tubular fibres, and produces its cells at intervals, either singly, or in clusters of from three to eight. The cells are large, and in shape resemble a grain of wheat; they are attached at one point below, and free at all the rest. The aperture is terminal and closed. The polypes have eight ciliated tentacula. When living, the cells are smooth; when dried they become wrinkled, as Ellis has figured them." *R. Q. Couch.*

3. V. PUSTULOSA, *dichotomous or alternately branched; the cells clustered, unilateral.* Ellis.

PLATE LXXII. FIG. 7—9.

Dichotomous tubular Coralline, *Ellis* Corall. 54, pl. 27, fig. *b. B.*—Sertularia pustulosa, *Ellis* and *Soland.* Zooph. 54. *Turt.* Gmel. iv. 680. *Bosc* Vers. iii. 113. *Stew.* Elem. ii. 444. *Turt.* Brit. Faun. 214. *Flem.* Brit. Anim. 551.—Vesicularia pustulosa, *Thomp.* Zool. Illust. 99, pl. 1, fig. 5-11.

Hab. Parasitical on Fuci. Isle of Wight, *Ellis.* Cove Harbour, *J. V. Thompson.* Youghal, *Miss Ball.* Belfast Bay, *W. Thompson.* Dublin Bay, not common, *A. H. Hassall.* Fowey Harbour, and off Goran, Cornwall, very rare, *C. W. Peach.*

This "arises from the surface of marine fuci with a straight flexuose stem, to the height of two or three inches, giving off at each flexure a spreading branch, which in like manner gives off secondary ones, all however, both primary and secondary, lying in the same plane, they are hence what botanists term distich; each flexure of

the stem and branches and each terminal branchlet is composed of a distinct joint, each of which is perforated by a double row of holes from 6 to 18 with elevated margins, on all of which in perfect specimens are placed oval transparent vesicles, furnished with animals having 8 tentacula : the rows of perforations having a spiral tendency, the clusters of vesicles hence present themselves in every direction." *J. V. Thompson.*

27. Bowerbankia,* Farre.

Character.—*Polypidom confervoid, matted or irregularly branched ; the cells sessile, unilateral, irregular, the inflected portion with a spinous or filamentous rim.—Polypes ascidian, with ten ciliated tentacula, and a strong gizzard.*

1. B. imbricata, *cells ovate or ovato-cylindrical, in dense clusters irregularly scattered on the polypidom.* Adams.

Plate LXXII. Fig. 5, 6.

Primary state. The Polypidom creeping and matted. (Fig. 71.)

Bowerbankia densa, *Farre* in Phil. Trans. an. 1837, p. 391, pl, 20 and 21. *Johns.* Brit. Zooph. 255. *W. Thompson* in Ann. Nat. Hist. v. 252. *Van Beneden* les Bryozaires, 29, pl. 4, fig. *A*.

Adult state. Polypidom arbuscular, erect.

Sertularia imbricata, *Adams* in Lin. Trans. v. 11, pl. 2, fig. 5-11. *Turt.* Gmel. iv. 683. *Turt.* Br. Faun. 216. *Stew.* Elem. ii. 450. *Thomp.* Zool. Illust. 94, pl. 1, fig. 1-4.—Valkeria glomerata, *Coldstream* in Edin. New Phil. Journ. ix. 235, pl. 2, fig. 1, 2 : and in Edin. Journ. Nat. and Geog. Sc. iii. 53. Serialaria imbricata et S. verticillata, *Templeton* in Mag. Nat. Hist. ix. 467, fig. 66.—Valkeria imbricata, *Johns.* Brit. Zooph. 254. *Hassall* in Ann. and Mag. Nat. Hist. vii. 363, pl. 8, fig. 2. *Couch* Corn. Faun. iii. 95, pl. 17, fig. 2.

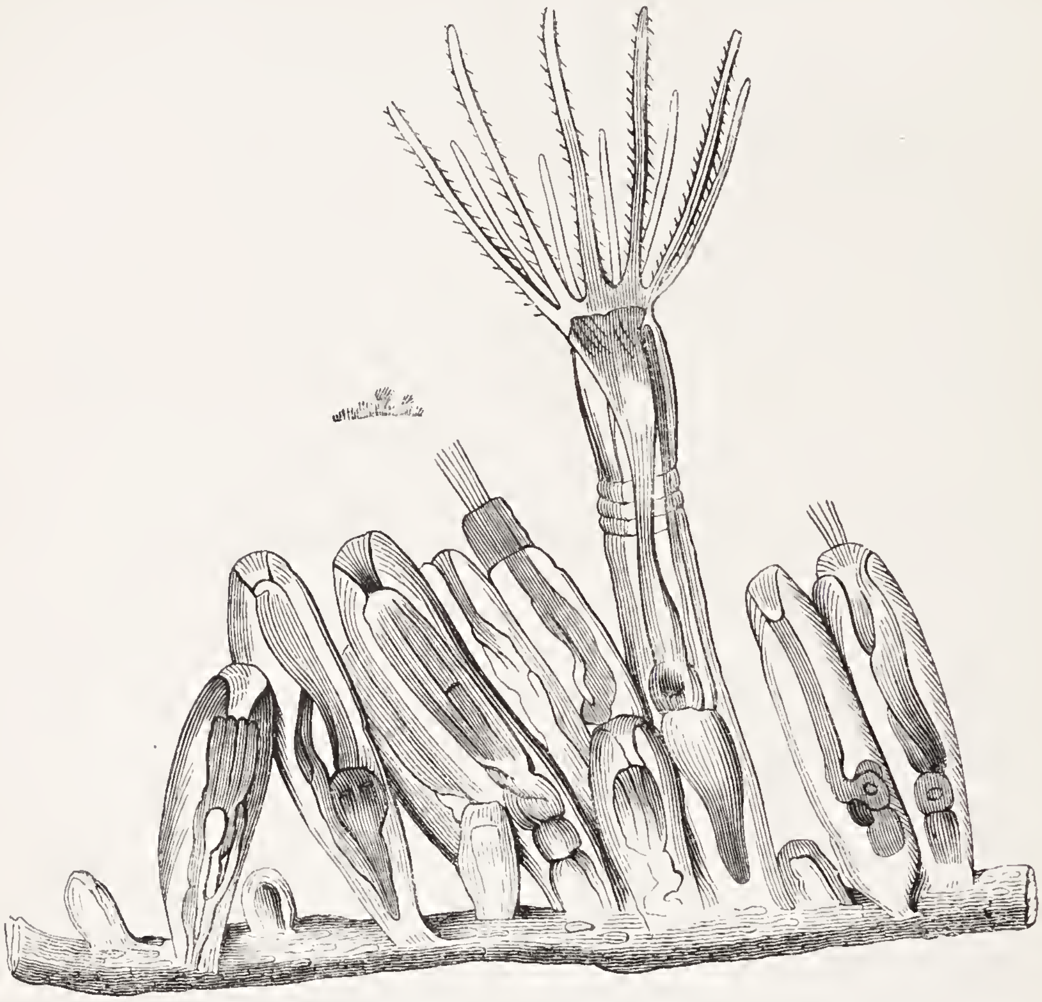
Hab. Parasitical on littoral Fuci and corallines, generally distributed on the British coast. It grows in profusion on the chains of the steam-ferries at Southampton and Portsmouth.

The polypidom grows in bushy confervoid flaccid tufts rising to the height of an inch and a half, much and irregularly branched, the lower branches spreading and often rooted to the body from which the zoophyte grows. The branches are smooth, transparent, and fistular,

* Believing it to be new I have named it after my friend Mr. Bowerbank, whose zeal displayed on this as on many other occasions, where the study of natural history may be promoted, was mainly instrumental in inducing me to follow up these investigations, on account of the many supplies that I received from him, and I gladly therefore take the opportunity of acknowledging and recording the obligation that I am under to him." *Dr. Farre.*

filled apparently with a granular fluid in a recent state, and loaded with cells, which, although sometimes solitary and scattered, are usually

Fig. 71



collected in irregular clusters aggregated on one side, and leaving the opposite side of the branch nearly bare of them. In specimens preserved in spirits the shape of the cells varies, arising partly from their different ages, and partly from the extent to which the polype has sunk and contracted within them at the moment of immersion : they are thus either obtusely conoid, ovate, pear-shaped, oblong or subcylindrical, sessile and contracted at the base.

I add the descriptions of those authors who have observed the species in a living state.

" Stem simple, slightly branched, partly creeping, partly erect : cells ovate, lengthened, with the mouths slightly compressed quadrangularly, scattered over the stem in irregular groups. Before the polype is evolved, the cell is closed at the distal extremity by a conical covering. Polypi with ten tentacula, finely ciliated : they extend considerably beyond the mouths of the cells, to the margins of which each is attached by a membrane, which is protruded before the tentacula when the polype is about to expand itself. When alarmed, it con-

tracts very rapidly." *Dr. Coldstream.*—According to Mr. J. V. Thompson this species creeps over the surface of the Fuci by means of its tubular ramifying roots, and throws off numerous flaccid irregularly branched shoots to the length of from one inch to one and a half or more, often so densely clustered as entirely to cover the plant on which it grows.

"The animal when fully expanded is about one-twelfth of an inch in length. In its retracted state it is completely inclosed in a delicate horny cell, sufficiently transparent to admit of the whole structure of the contained animal being seen through its parietes. The cells are connected together by a cylindrical creeping stem, upon which they are thickly set, and sessile, ascending from its sides and upper surface."

"The animal when completely expanded is seen to possess ten arms of about one-third the length of the whole body, each arm being thickly ciliated on either side, and armed at the back by about a dozen fine hair-like processes, which project at nearly right angles from the tentacula, remaining motionless, while the cilia are in constant and active vibration." *Farre.*

B. "*imbricata,* in the first stage of its formation, consists of a single layer of cells spread over the surface to which it is attached (usually *Fucus vesiculosus*), and not rising from it in the form of an independent polypidom. In this stage of its growth it constitutes the *Bowerbankia densa* of Dr. Farre. This fact I have ascertained from a comparison of Dr. Farre's figure and description of that species with it, and its concurrence with these is so close as not to admit of a doubt upon the subject. *Bowerbankia densa* is, therefore, not a distinct species, but merely a condition of the well-known one, *Valkeria imbricata.* Although the examination of numerous specimens of *V. imbricata* which I have made has resulted in the eradication of *B. densa* as a distinct species, I yet must not omit to notice the admirable memoir published in the 'Philosophical Transactions,' upon this and an allied species by Dr. Farre, the gentleman by whom *Bowerbankia densa* was first described and figured as a distinct species, and to whom we are indebted for almost all we know of the anatomy of the Ascidian type of zoophytes.

"Some time since I forwarded to Dr. Johnston specimens under the name of *Bowerbankia densa* for examination; one of them was in fact *Valkeria imbricata* in the primary stage of its growth, that is, spreading over a plain surface; the other was elevated in the form of a distinct polypidom, the condition in which *V. imbricata* is

usually met with. I remarked on these specimens somewhat to the following effect, not at the time recognising them as belonging to the species *Valkeria imbricata*, that they represented the species *Bowerbankia densa*, and that *it* did not always confine itself to the surface of the object upon which *it* grew, but sometimes rose from it as a separate polypidom. Dr. Johnston remarked upon them, that they represented 'the species in its perfect state.' In another letter Dr. Johnston writes, 'Accidentally viewing your specimens of *Bowerbankia densa*, var. *ramosa*, it at once flashed on my mind that they were *Valkeria imbricata*, which is indeed the fact. *Bowerbankia densa* and *Valkeria imbricata*, are they not states of the one and the same species? Your observations will probably result in the erasure of a spurious species.' I have thus Dr. Johnston's testimony in favour of the identity of *Bowerbankia densa* and *Valkeria imbricata*."*

"I may here observe, that many species of zoophytes, as well as the above, spread over the surface of attachment in a single layer, prior to becoming elevated into separate and independent polypidoms. This with many species appears to be a law of their growth, and is very obvious in the Flustras." *A. H. Hassall.*

28. Farrella,† Ehrenberg.

Lagenella, *Farre* in Phil. Trans. an. 1837.—Farrella, *Ehrenberg* in Ann. and Mag. Nat. Hist. vii, p. 303.—Laguncula, *Van Beneden* Mem. 5.

Character.—*Polypidom confervoid, creeping, fistular and membranous; the cells elliptical, scattered.—Polypes ascidian with the tentacula forming a rather incomplete circle: no gizzard; ova on exclusion without cilia.*

1. F. repens, *cells oblong, on a pedicle much shorter than itself; tentacula twelve.* (Fig. 58, p. 253.) A. Farre.

Lagenella repens, *Farre* in Phil. Trans. an. 1837, p. 403, pl. 24. *W. Thompson* in Ann. Nat. Hist. v. 252. *Hassall* in Ann. and Mag. N. Hist. vii. 364.—Bower-

* In the MSS. of *W. Thompson* I find the following note:—"The first time I gave any attention to this species (Valkeria imbricata) in situ was in Clew Bay, co. Mayo, in July 1840, when it was obvious that Bowerbankia densa, which appeared in quantities along with it, was only its early state. I remarked the same in Roundstone bay soon afterwards." G. J.

† The name Lagenella having been appropriated to an infusorial animalcule in 1832, Ehrenberg applied to the ascidian zoophyte so called the name Farrella, in honour of *Dr. Arthur Farre*, the discoverer of the genus. Van Beneden has given its history in an admirable Memoir published in 1845.

bankia repens, *Johns.* Brit. Zooph. 256.—Laguncula repens, *Van Beneden* Rech. 25, pl. 1, and pl. 2, A.

Hab. "Parasitic, with a creeping stem, on Sertularia and on Halodactylus diaphanus. Not very common," *Farre.* In Strangford lough, parasitical on sea weeds, *W. Thompson.*

"This species has twelve ciliated arms, not spiny. The alimentary canal is short and stout, and whilst the animal is expanded remains high up in the body. During retraction the stomach is never brought down to the bottom of the cell, but remains suspended from the upper part of it by the intestine, which appears to have some attachment at this point. The upper part of the tube, however, is generally brought down lower than the stomach, in order that the tentacles may be completely drawn in. By this suspension of the stomach from the upper part of the cell a fixed joint is obtained, from which the retracted flexed portion of the tube may erect itself with the same effect as if the stomach were in contact with the bottom of the cell. This is a point which it would be important to observe in generic distinctions; but here, as with many other points in this species, my observations were not carried to the extent that they have been in others, as this was one of the specimens with which my investigations were commenced, and I have never since had an opportunity of confirming them."

"The cells have an oblong form, and are connected to their narrow creeping stem by a short peduncle. The opercular portion terminates in a notched margin, and is very short. (It is possible that this notched margin may be formed by the extremities of short and broad setæ, but this was not determined.) The cells spring from the sides and upper surface of the stem, and turn upwards as in Bowerbankia. They are set at some distance apart." *Farre.*

Van Beneden says that the tentacula vary from 10 to 12, and that they are less regular than in other genera of the order, with an indication of a binary disposition, as if they were tending to the crescentic figure of those of the fresh-water Polyzoa.

FAMILY—PEDICELLINÆ.

Polypiaria pedicellinea, *P. Gervais* in Ann. des Sc. Nat. vii (1837), 80.

29. Pedicellina,* Sars.

Character.—*Polypes invested with a thin transparent poly-*

* Formed from pes, -edis—a foot.—The definition given by Sars is as follows:—"Corpora gelatinosa nuda, pedicellata, clavata, in surculo tereti repente verticalia.

pidom, pedicled, clavate, rising from a filiform creeping shoot: the club abdominal, oblong, dilatable, encircled above with a series of short ciliated tentacula, which roll themselves up when at rest, and are not withdrawn into the polypidom.

1. P. ECHINATA, *with the pedicles spinous.* Ellis.

PLATE LXX. FIG. 5.

Fleshy Polypes of a red colour and a particular kind, *Ellis* Corall. pl. 38, fig. 5, E, F. —Hydra Coronata, *Flem.* Brit. Anim. 554. *Lister* in Phil. Trans. an. 1834, p. 385, pl. 12, fig. 6. *Sharpey* in Cyclop. Anat. and Phys. i. p. 610, fig. 293.—Pedicellina echinata, *pedicellis echinatis*, *Sars* Beskr. 5, pl. 1, fig. 1. *Hassall* in Ann. and Mag. Nat. Hist. vii. 365. *W. Thompson* in Ibid. xiii. 440. Ann. N. Hist. xv. 312, pl. 20, fig. 5. *J. Reid* in Ibid. xvi. 390.

Hab.—Parasitical on corallines and sea-weeds between tide marks, but especially near low-water mark.

Polypes gregarious or clustered, rising from a creeping flexuous, subcorneous, transparent fibre attached closely to the object on which it grows; the pedicle from two to four lines in height, similar in structure to the radical fibre but roughish with scattered short obtuse spines, tapered a little near the top where it is inserted laterally into a proportionably large head that contains the viscera and is encircled on the top with the numerous short tentacula.

"Before meeting with Sars' work," says Mr. Hassall, "I had ventured to change Fleming's decidedly incorrect generic appellation of *Hydra*, and to substitute in its place that of *Cardua*, retaining the specific term. I was induced to confer this name upon it from the great resemblance which the polypes of this zoophyte bear to the heads of thistles, and this resemblance is strengthened by the presence of hairs upon their surface. A descending gullet, stomach, and ascending rectum, are distinctly visible. Just above the stomach, and apparently connected with it, a yellow body may be noticed: this is in all probability a liver; it is not a gizzard, as no food was seen to pass into it, although I was able to trace its passage in its whole course along the intestinal canal. Above this yellow body a dark, ill-defined mass is seen, the nature of which I am not able to

Clava oblonga, compressa, varie dilatabilis, supra serie tentaculorum coronata. Tentacula cylindrica cirrata. Os et anus vicina in extremitate superiore excavata."—The naturalist will find a translation of Sars' account of this genus in the Ann. and Mag. N. Hist. xv. p. 381-2.—Before he became acquainted with Sars' work, Van Beneden had named the genus *Crinomorpha*.

determine.* The tentacula are about one-third the length of the head of the polypus, and are about sixteen in number, tuberculated, and thickly ciliated, as is also the interior of the whole line of the alimentary canal. Near the junction of the stomach and ascending rectum, and contained within them, a small dark body may often be observed in active rotatory movement; the nature of the body, which has been noticed in some other zoophytes, and the cause of its motion, have not, I believe, been fully understood: it is nothing more than fæcal matter kept in constant rotation by the action of the cilia lining the whole internal surface of the alimentary canal, and which, by their peculiar arrangement, drive it on towards the place by which it is to make its exit—thus supplying the office of proper propelling muscles. The polypi are usually non-symmetrical, one side being more bulged out than the other, but they are capable of assuming various other forms and appearances. The tentacula, too, vary much in their disposition, being sometimes directed either upwards or outwards; at others they are curved inwards, usually to a small extent, but occasionally so much so as to be entirely lost to view, being concealed by the outer tunic of the polypus. The motions of the polypi of this species are very lively and peculiar. All the Ascidian zoophytes are much more vivacious and active in their movements than the Hydroid, and this is the necessary result of their higher organization."

Mr. Lister's description of this zoophyte is as follows:—

"It consists of a creeping tube and a number of stems branching from it, each ending in an animal that is shown (not very distinctly) at fig. 42, *d*. The stems, though commonly still, have free power of motion; and when one is disturbed it bends quickly to and fro, so as to strike one or two more; these again strike upon others, and thus for a few seconds all are in action: but they soon return to quietness, and the arms, which during the commotion had been doubled in, open again.

"The arms are placed on the edge of a pretty transparent tunic, and have granulations on their back. They are fringed with ciliæ possessing the same action as those of Ascidiæ and Flustræ; and in the specimen drawn, small substances were occasionally seen carried downwards along them. As in Flustra, a part of the intestine had within it a revolution of particles and dark matter round its axis, and this part communicated with an ascending rectum. The arms at the part of the circle opposite to the rectum appeared to be con-

* Van Beneden says that this is the generative system.

tinued below the edge of the tunic, and the current produced in the water, and the food it brought, flowed into a cavity there, at the bottom of which was active indistinct motion as if of filaments. A connexion was thought to exist between that part and the place where the revolution was going on, but no act of deglutition was perceived.

"No current of blood was visible in the stem, nor any circulation either in the body or the arms. Much of the space within the tunic was occupied by a darkish appearance, the nature of which was not ascertained. I had not opportunity to inspect other individuals, but the species seemed to be intermediate between such animals of Flustra as I had met with, and the pedunculated compound Ascidia; more nearly related to the former, but approaching the latter in the form of the lower part of the body, the position of the rectum, and the absence of all apparent effort of swallowing: and if with the help of imagination we could connect the ciliated arms together by cross bands at intervals and unite their ends in a circle, extending the tunic to meet that circle, and leaving an opening for the funnel where the rectum is placed, the organ would not be unlike the branchiæ of some Ascidiæ. Indeed the affinity appeared to me not very distant between Ascidia and Flustra; while, to the Sertulariæ, except in the resemblance given by their projecting arms, I can discover no more analogy in the Flustræ than in the Ascidiæ themselves."—*Lister.*

The pedicles are often so infested with microscopic parasitical Diatomaceæ that their spinous character is obscured or rendered uncertain; and I think it not improbable that Mr. Lister and Professor Sharpey were thus induced to represent the stalks without any spines. "In some specimens," says Professor J. Reid, "the stalk is nearly smooth, in others several spinous-looking processes project from it, and in others both stalk and body are covered with a long, fine, and sparse down."

Pedicellina echinata is, according to Professor Reid, more hardy than most of the other ascidian polypes, and can be kept alive at home for a long time. The number of tentacula varies from fourteen to twenty. Like the hydroid Tubularinæ, the life of the body is of shorter duration than that of the stalks, the former fading and falling off, when a new one is reproduced in its place. "A few days before this takes place, the tentacula are permanently bent inwards and the membrane surrounding their lower part remains contracted, so as to completely, or nearly completely, cover the upper surface of the body,

presenting in fact the appearance which the animal temporarily assumes when disturbed. The body then becomes more opaque, and at last falls off. After this the stalk retains its property of alternately contracting and relaxing its different surfaces at intervals, upon which its movements depend. After the lapse of a few days the top of the stalk enlarges, and a minute head presents itself, in which the different parts of the body are developed."

The Pedicellina is the subject of one of Van Beneden's masterly essays on the Bryozoa, to which the student of these animals may be confidently referred for the fullest information, detailed in a clear and lively manner, and illustrated with admirable figures. The observations of Professor J. Reid form a valuable supplement to the memoir of the Belgian naturalist.

The Pedicellina gracilis of Sars may be known by the stem being quite smooth and free from prickles, and it is also thinner and proportionably longer than in P. echinata. See Ann. and Mag. N. Hist. xv. 382.

The Pedicellina belgica of Van Beneden has also a smooth stem and pedicle, but it bulges out about the middle, being narrower both above and below. The polype has twelve tentacula, whereas there are about twenty to P. gracilis.—Both these species may be expected to be found on the British coast.

The position of the remarkable genus Forbesia of H. D. S. Goodsir (Ann. and Mag. N. Hist. xv. 380, pl. xx. fig. 4.) is uncertain. Mr. Goodsir considers it equally related to Pedicellina and to Vorticella,—"the link which connects the Infusoria just named with the Polypi,"—while Van Beneden maintains that it should rather be referred to the family Echiuridæ, in the class Echinodermata.

POLYZOA HYPPOCREPIA.

POLYPIARIA HYPPOCREPIA, *P. Gervais* in Ann. des Sc. Nat. vii. (1837) p. 77.—POLYZOA HYPPOCREPIA, *J. E. Gray* in Syn. Brit. Mus. (1842) p. 135.—LIMNIADES, *Johns.* Brit. Zooph. 248. *Allman* in Ann. and Mag. N. Hist. xiii.

The organization of the polypes of this order is essentially the same as that of the Polyzoa infundibulata; but the circle of tentacula around the mouth is interrupted, in most of them, on one side, so that they form a horse-shoe shaped group. The distinction of sexes in the individuals is also more distinctly proved; and the ova are not only not ciliated, but they have a distinct envelope or shell.

I follow Professor Allman in the arrangement and definition of the genera. The following is a synopsis of them:—

Polype-mass floating. *CRISTATELLIDÆ.*

  One genus only . . . . . CRISTATELLA.

Polype-mass rooted.

  Massive or confervoid, inarticulate. *PLUMATELLIDÆ.*

    Massive and sponge-like . . . ALCYONELLA.

    Confervoid

      Tentacular disc crescentic. . PLUMATELLA.

      „ „ orbicular . . FREDERICELLA.

  Confervoid, jointed. *PALUDICELLAIDÆ.*

    One genus only. . . . . PALUDICELLA.

POLYZOA HYPPOCREPIA.

FAMILY—CRISTATELLIDÆ.

30. Cristatella,* Cuvier.

Character.—" *Polypidom free, contractile, locomotive. Polypes issuing from apertures arranged upon the upper surface; tentacular disc crescentic. Ova with marginal spines.*" Allman.

1. C. mucedo. Sir John Graham Dalyell.†

Plate LXXIII.

De kleine Vederbos-polyp, met het balvormig lyf, *Rosel* Hist. der Insect. iii. Polyp. 517, pl. 91.—Cristatella mucedo, *Cuv.* Reg. Anim. iii. 296. *Gervais* in Ann. des Sc. Nat., Part. Zool., vii. 77, n. s. *Turpin* in ibid. vii. 65, pl. 2 and 3, fig. 1—7. *Allman* in the Athenæum, Sept. 1846, p. 1005.—C. vagans, *Lam.* Anim. s. Vert. ii. 97., 2de edit. ii. 110. *Blainv.* Actinolog. 489 and 678, pl. 85, fig. 7. *Bosc* Vers, iii. 180, pl. 30, fig. 9. *Stark* Elem. ii. 442.—C. mirabilis, *Dalyell* in Edin. new Phil. Journ. xvii. 414; and in Rep. Brit. Assoc. an. 1834, 604.

Hab. " An inhabitant of the fresh waters of Scotland," *Sir J. G. Dalyell.* And of those of Ireland, *Professor Allman.*

" Perfect specimens occur from six lines to twenty-four in length, by two or three in breadth, of a flattened figure, fine translucent green colour, and fleshy consistence. Some of the shorter, tending to an elliptical form, may be compared to the external section of an ellipsoid; but those of the largest dimensions are linear, that is, with parallel sides and curved extremities." " The middle of the upper and the whole of the under surface are smooth; the former somewhat convex, occasioned by a border of 70 or 80, or even of 350 individual polypi, disposed in a triple row. Their number depends

* The diminutive of *cristata*, crested.

† The author of a very interesting work on the Planariæ, and of some very important researches into the physiology of the aquatic invertebrate animals in general, the fuller publication of which naturalists expect with impatience. Sir John is the translator also of some of Spallanzani's works; and by other learned works he is well known to antiquaries.

entirely on the size of the specimen,—increasing as long as it grows."

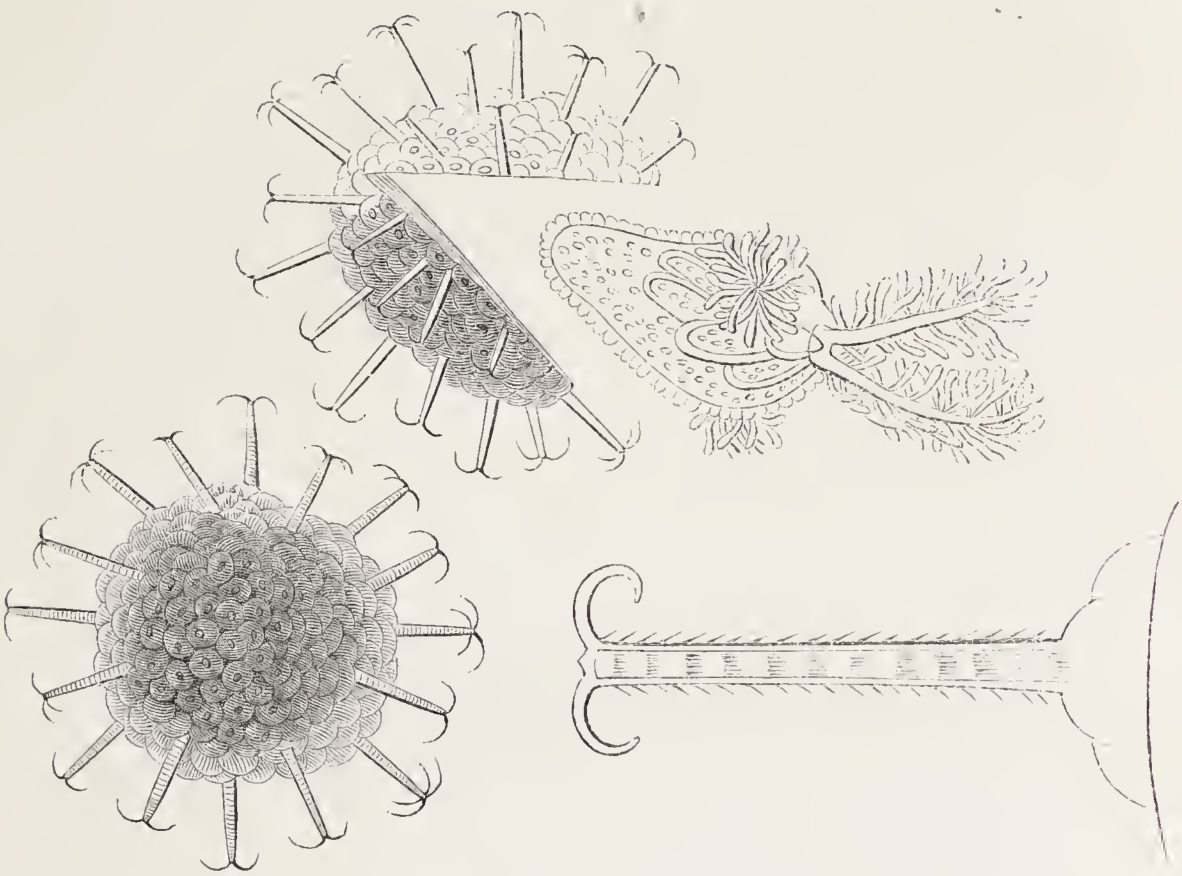
"This product is endowed with the faculty of locomotion, either extremity indifferently being in advance, but its progression, uncommonly slow, seldom exceeds an inch in twelve or twenty-four hours. Each of the numerous polypi, though an integral portion of the common mass, is a distinct animal, endowed with separate action and sensation. The body, rising about a line by a tubular fleshy stem, is crowned by a head which may be circumscribed by a circle as much in diameter, formed as a horse-shoe, and bordered by a hundred tentacula. Towards one side, the mouth, of singular mechanism, seems to have projecting lips and to open as a valve, which folds up within, conveying the particles which are absorbed to the wide orifice of an intestinal organ which descends, perhaps in a convolution, below, and returns again to terminate in an excretory canal under the site of the tentacula. Probably the whole race of Cristatellæ is distinguished by a similar conformation."

"The polypus is a very vivacious animal, quickly retreating for security when alarmed, and rising to expand in activity. Though each be endowed with independent life, sensation, and all the motions that can be exercised without actual transition, the whole are subjected to the volition of the sluggish mass in respect to progression: —they are borne along with it." "A specimen having been cut transversely asunder, each portion seemed to recede by common consent; but both survived, as if sustaining no injury. Neither is any polypus affected by the violence offered in its vicinity.

"Twenty, thirty, or more lenticular substances, of considerable size and in the most irregular arrangement, imbedded in the flesh, are exposed through the translucent green of the animal. Its death and decomposition towards the end of autumn liberate them to float in the water. Subjected to the microscope, or, indeed to the naked eye, their convex surfaces prove brown, the circumference yellow, and begirt with a row of spines terminating in double hooks. Each is an ovum of the Cristatella with a hard shell, and occupied by yellowish fluid contents." "In five or six months the ovum gapes at one side to allow the protrusion of an originating polypus, which by a remarkable provision of nature now floats reversed, with the head downwards, to ensure absorption of the liquid element below. On quitting the ovum it attaches itself to some solid substance by the base, then disproportionately large, from which a second polypus quickly rises, then a third, and a fourth; and thus with others. In

earlier stages the Cristatella mirabilis seems to be of a circular figure, and in its most mature state there is a margin projecting beyond the root of the polypi." *Dalyell.*

Fig. 72.



To illustrate this description of Sir J. G. Dalyell, I have given copies, of the beautiful figures of M. Turpin in Plate 73, for there can surely be scarce a question of the identity of the continental and British zoophyte. Turpin's figures, it is to be noticed, were drawn from young or slightly developed specimens; a mature polypidom, with its three hundred individuals, must indeed present to the naturalist a spectacle of such singular curiosity and beauty, as perhaps can meet its superior or rival in no other creature. I am unwilling to borrow, from the memoirs of the foreign authors, any additions to Sir J. G. Dalyell's short history, for I am aware of the confusion to which such a practice has occasionally led, but no harm can arise from the mention of some particulars which are evidently generical. I may state, then, that the tentacula are ciliated like those of other ascidians; the intestine has an oral and anal aperture, the latter with a medial position; and there is no trace of any organ like what, in some other families of the order, has been reckoned an

ovary. The egg, according to M. Turpin, forms a small flattened sphere, with a papillous surface slightly incrusted with calcareous matter. The centre is of a dark reddish-brown or vinous colour, the margin more transparent and yellowish, proving that the egg is vesicular,—the exterior circle marking out the thickness of the cocoon or shell, and the more opake disk the part occupied with the embryotic fluid. About sixteen rough spines radiate stiffly from the circumference: they are tubular, yellow, terminated with from two to four crotchets, and apparently vary in length, for they arise alternately from the edge and from the surface a little behind this.* The egg is filled with an albuminous granular fluid analogous to the vitellus or yolk, for in it the fœtus is perfected after a period which probably depends, in a great measure, on the temperature of the season in which the egg is laid. The time of birth having arrived, the shell opens in two gaping halves, as an oyster opens its valves, to permit the escape of the young polypus, which enters on its existence complete in all respects, either a single individual, or with one or two others, less mature, pullulating from the sides.

One of the most interesting facts ascertained by M. Turpin is that the eggs before exclusion, and immediately after, are oval or lenticular, and *entirely free of the spines* which roughen them at a later stage.† Hence an easy solution of a question touching the manner of the egg's escape from the mother, which, before this discovery, seemed incapable of being effected without a painful laceration from its bristling armature. This alteration in the structure of the egg is very remarkable, although not singular, for the eggs of several mites are known to undergo somewhat similar changes. The eggs float in the water from their lesser specific gravity, but often they become attached by their spines to the filaments of confervæ, &c., where they float until the young are hatched, and where these find an immediate place of rest.

M. Turpin has stated that some varieties of silex contain immense numbers of the ova of the Cristatella and Alcyonella, preserved in

* According to M. P. Gervais this is not the case,—the spines originate solely from the line of junction between the marginal band and the disk:—"du point de contact de cet anneau et du corps disciforme partaient sur l'une des faces les crochets dont j'ai parlé. Je reconnus depuis que l'autre face présentait aussi les appendices en crochets, mais qu'ils y étaient moins allongés."

† "The ova in their young state are inclosed in a ciliated membrane, and the hooked spines with which, in their more mature condition, they are furnished, are developed within the ciliated investment, being yet fully formed previously to the ova quitting the parent." *Prof. Allman.*

entire perfection; (Ann. des Sc. Nat., Part. Zool., vii. 120, plates 6 and 7;) but it appears that he has confounded the ova of the Cristatella with true infusorial Xanthidia. See Ann. Nat. Hist. iii. 444.

FAMILY—PLUMATELLIDÆ.

31. Alcyonella,* Lamarck.

Character.—*Polypidom fixed, encrusting or floating, in the form of an irregular sponge-like mass composed of vertical aggregated membranaceous tubes opening on the surface. Polypes ascidian, the mouth encircled with a single series of filiform tentacula, depressed or incomplete on one side: eggs coriaceous, smooth.*

1. A. stagnorum.

Plate LXXIV.

Variation α. *Sponge-like, massive.*—Alcyonium fluviatile, *Bosc* Vers, iii. 159. Corall. 250.—Ephydatia Gibbsii, *Gray* Brit. Pl. i. 353.—Alcyonella stagnorum, *Lam.* Anim. s. Vert. ii. 102, 2de edit. ii. 116. *Stark* Elem. ii. 442. *Lamour.* Soland. tab. 76, fig. 5—8 (bad). *Teale* in Trans. Leeds Phil. and Lit. Soc. i. 116, pl. 12; and in Mag. Zool. and Bot. i. 293.—A. fluviatilis, *Raspail* in Mém. de la Soc. d'Hist. Nat. de Paris, iv. 130, pl. 12—16.—L'Alcyonella des étangs, *Blainv.* Actinolog. 491, pl. 85, fig. 8.

Variation β. *Polypidom lobed or stellate.*—Polypes à Panache, *Tremb.* Mém. 210, pl. 10, fig. 8, 9. *Reaum.* Mém. des Insect. vi. pref. lxxvi.—The Bell-Flower Animal or Plumed Polype, *Baker* Employ. Micros. 306, pl. 12, fig. 15—22.—Hydra campanulata, *Lin.* Syst., edit. 10, 817.—Tubularia crystallina, *Pall.* Elench. 85.—T. campanulata, *Lin.* Syst. 1303. *Berk.* Syn. i. 215. *Shaw* Nat. Misc. x. pl. 354. *Turt.* Gmel. iv. 668. *Turt.* Brit. Faun. 211. *Adams* on the Microscope, 449, pl. 22, fig. 32. *Bosc* Vers, iii. 92. *Blumenb.* Man. 272.—Leucophra heteroclita, *Müll.* Infus. 158, pl. 32, fig. 27—34, copied in Encyclop. Méthod. Vers, pl. 11, fig. 40—46 (in its fœtal condition).—T. reptans, *Bosc* Vers, iii. 93.—Plumatella cristata, *Lam.* Anim. s. Vert. ii. 107, 2de edit. ii. 122. *Stark* Elem. ii. 441. *Blainv.* Actinol. 490.—Pl. campanulata, *Risso* L'Europ. Mérid. v. 308.—Naisa reptans, Corall. 99, pl. 6, fig. 4.—Cristatella campanulata, *Flem.* Brit. Anim. 518.—C. paludosa, *Dalyell* in Rep. Brit. Assoc. an. 1834, 606.

Hab. Stagnant waters, especially in such as are tinctured with iron in solution; their development chiefly in autumn.

Polypidom, when at maturity, in large amorphous compact masses, soft, compressible, and somewhat elastic, of a blackish-green colour, irregularly lobulated or sinuous on the surface, which has a lubri-

* A diminutive from *Halcyon.* The sponge genus *Alcyonellum* of Quoy and Gaymard, being of subsequent creation, cannot be retained.

cous appearance, and is more or less apparently porous. The mass is composed of subcylindrical tubes rising from the base to the surface, nearly parallel, connected by, or permeating, a transparent firm jelly-like substance, with which the tubes appear to be also partially filled. The tubes are simple or unbranched, and open outwardly by a roundish or pentagonal aperture, which is closed by a thin membranous cover. The walls of the tubes are of the same thin membranous character, pellucid, colourless, or tinted with green, and without any visible vessels; they contain innumerable lenticular ova of a dark brown colour, about half a line in their longest diameter, very hard and incompressible, but in drying the centre becomes depressed and more transparent than the edges. These singular ova are quite smooth,* and arranged in rows in the tubes, though not very regularly; they are more abundant near the surface than at the base of the polypidom, and exist in such amazing numbers as to excite surprise at the seeming productiveness of an animal which appears to be very partially diffused, and is very capricious in its appearance even in ponds favourable for its growth,—swarming in one season, of rare occurrence in the next, and perhaps then for years lying dormant, until some undiscovered cause hatches the egg and renews its pristine fertility. When freed from the mass, the greater number of the ova swim on the surface of the water, but some sink to the bottom.

To this description, derived from specimens in a recent, but not living condition, sent me by Mr. Embleton, I add the following particulars derived from Mr. Teale's valuable paper. A good idea of the polype will be obtained by reference to figures 5, 6, of Plate lxxiv, which are reduced copies of Raspail's. It is organically connected with the mass, the tube forming its tunic, from which the animated body issues by a process of evolution, similar to that which developes the horn of a snail. When developed, the head projects a short way, and is crowned with a "beautiful expansion of tentacula, about fifty in number, arranged in an unbroken circle, which is, however, depressed into a deep concavity on one of its sides, so as to produce the appearance of a double row of tentacula in a horse-shoe form. About one thousand six hundred polypes are situated on a square inch of surface of the mass, consequently the number of

* M. Meyen says, on the contrary, that the envelope of the ovum is covered with very fine vibratile cilia. Bull. des Sciences Nat. xviii. 313. Has not Meyen mistaken the ova or seeds of the Spongilla for those of the Alcyonella? for undoubtedly the ova of the latter are smooth.

polypes" in one specimen which weighed seventeen ounces, and measured fourteen inches and a half in circumference, "may be computed at one hundred and six thousand, and the tentacula at five millions three hundred and twenty thousand!" The mouth is, as usual, in the centre of the crater formed by the tentacula, and is the entrance to an alimentary canal, that, descending in the body, swells out into a stomach, and then bends to gain an upward course, having its termination exterior to and underneath the indenture in the tentacular circle. "The lower portion of the stomach is of a bright brown colour, longitudinally striated. The colour appears to depend upon the alimentary materials which it contains, and the vertical striæ are probably produced by folds in the organ. On lacerating the stomach, the brown matter escapes in the form of innumerable minute granules. A sort of vermicular motion is sometimes observed in the stomach."

The ova are generated in that portion of the polype-tubes which is prolonged from the stomach through the common mass (fig. 2), not germinating in any certain point, but from all the gelatinous sides. "Those which are perfectly matured are of a dark reddish-brown colour. Others of the same size have their external envelope opake and white; others are somewhat smaller and translucent, whilst some are very minute and perfectly transparent. The mature and immature ova appear scattered indiscriminately throughout the tube. The ova are stated by Raspail to occur in a double series; I have, however, almost invariably found them in a single row. M. Raspail also says he has been able to see the small filament which connects the ova to their containing membranous tube."——There appears to be no duct or aperture through which the ova can escape, their liberation being apparently dependent on the decomposition of the body. This is of two kinds: "In the first, the papilla, which during life closes the tube, dies and becomes softened, ragged, and flocculent, and in this state no longer forms a barrier to the exit of the ova. In November, many of the specimens were seen in this condition. On examining the surface of the polypiferous masses, they were seen covered with ragged shreds of membrane, instead of the well-defined conical papillæ or expanded polypes. In the second stage, air is disengaged from decomposition of the contents of the horny tube or ovary. If a recently dead specimen, in which the papillæ are reduced to the state above described, be examined with the lens, a succession of air-bubbles are seen frequently escaping from the horny tubes. By the successive formation and ascent of

these bubbles, the ova, which at this period are loose and floating in the tubes, are gradually elevated and conveyed to the exterior. In November many of the specimens were seen with air-bubbles and ova successively escaping, and the external surface was covered by ova thus conveyed to the exterior. Those specimens which were black and putrid, and appeared to have been dead some time, exhibited the horny tubes nearly devoid of ova. After a time the horny basis itself becomes softened, and appears to undergo decomposition. During the following spring, according to the evidence of Vaucher and Raspail, the horny envelope of each ovum separates into two lateral halves, adhering on one side as by a hinge. From these valves a small gelatinous tubercle projects, which soon expands into a distinct polype, and gradually becomes elongated into a tubular form. From the sides of this tubular polype, small gelatinous buds soon appear, and these again become developed into distinct polypes; the tubular parietes gradually become consolidated, and form the horny basis of the mature Alcyonella."

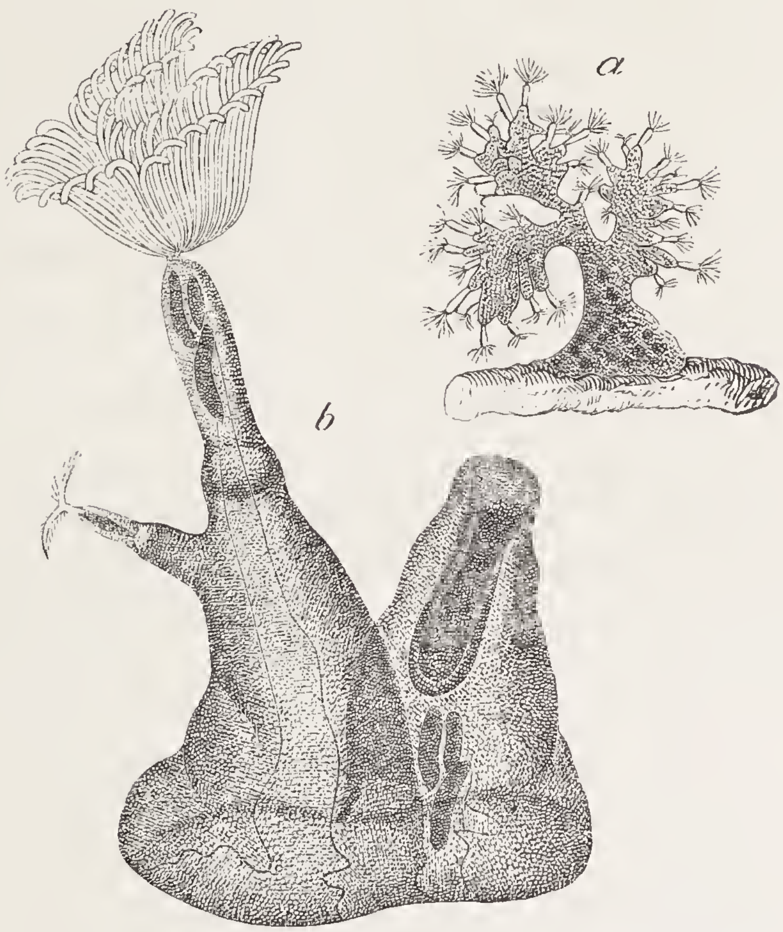
The Alcyonella, if I have correctly sorted the synonymes, was discovered by Trembley in the spring of 1741. It seems necessary to give a copy of his figures here (wood-cut, No. 73), since on them is founded the second variation of the species, and they exhibit it in a guise very different from that represented in our Plate 74. His history of the animal is marked with much of that excellence which distinguishes the inquiries of this naturalist. He correctly describes the connection and relationship between the polype and the common mass; the arrangement of the tentacula, and the structure of the alimentary canal, although he failed to detect the anus. He overlooked the cilia of the tentacula from employing magnifiers of too low a power, and attributed the whirlpools created in the water by their play to the motion of the tentacula themselves, which he says were also used separately to force the animalcular prey into the mouth. He knew that the polypes were not contractile, and believed their retraction within the tubes was dependent on the play of a muscular thread which descended from the body in the common mass.* The gemmiparous mode of increase in the polypidom is also detailed with some minuteness, but he had not seen the ova, at least in a state of maturity.†

* Professor Allman thinks that the organ which Trembley took for a retractor muscle is an ovary. On Paludicella articulata, p. 8.

† It is even doubtful whether the bodies he took for *immature* ova were really so. " J'ai vu dans plusieurs des Polypes à Panache, sur lesquels j'ai fait mes observations,

Immediately after Trembley's discovery, Reaumur and Bernard de Jussieu found this animal in the neighbourhood of Paris, and detected its ova, from which they saw the young issue. Reaumur's account of the growth of the compound animal appears to me to corroborate the opinion of the sameness of the Plumatella and Alcyonella. He says that while the polypes à panache are still very young, they increase in the same manner as the locomotive

Fig. 73.



polypes do, with one difference only, which it is essential to note, since it explains clearly the formation of those polypidoms that resemble plants. The tube of a newly evolved polype continues as it were permanently grafted upon the tube of that which has given birth to it: from the polype tube he has seen germinate by little and little another which contained a nascent polype; he has seen this tube elongate itself, and the polype tenant at length show itself outwards to follow out the destined tenor of its life. Scarcely had a few days passed, until this again gave birth to a young one whose

de petit corps sphériques de différentes grandeurs, blancs et transparens. J'ai seulement soupçonné que ces petits corps étaient des œufs, mais je n'ai pas eu occasion d'examiner si ce soupçon étoit fondé, ou non." p. 219.

tube was in connection with the parent's, and continued so. In this manner he has seen files of tubes and polypes formed, grafted the one on the other; he has seen these unite in polypidoms which there would have been no hesitation in regarding as plants, if he had not followed them in the progress of their growth, and if he had not had the opportunity of convincing himself that the whole was but the assemblage of cells constructed and developed one after another, and inhabited by animalcules.

Baker next described the animal in what Raspail considers its second stage of development; and as his description is derived from native specimens, I insert it entire, anxious to give as much completeness as possible to the history of a zoophyte which appears under so many phases, and regarding which there still exist considerable doubts. "I was first informed," Baker says, "of this creature by my industrious friend, Mr. William Anderson, towards the end of the year 1743, as his letters shew: and in the year 1744, it was taken notice of by Mr. Trembley, who gave it, in his Memoirs, the name of the *Polype à Panache*, or the Plumed Polype. My friend, who discovered it in his searches for the polype, called it the Bell-Flower Animal; and after favouring me with his own observations, sent me some of the creatures themselves, which living with me for several months, I had sufficient time and opportunity to examine and consider them. And as there seems some little difference between those in my keeping, and what Mr. Trembley describes, they may possibly be of another species, though of the same genus.

"This is one of the many kinds of water animals which live as it were in societies; of which some sorts hang together in clusters, but can detach themselves at pleasure; whilst others are so intimately joined and connected together, that no one seems capable of moving or changing place without affecting the quiet and situation of all the rest. But this creature forms as it were an intermediate gradation between the other two, dwelling in the same general habitation with others of its own species, from whence it cannot entirely separate itself; and yet therein it appears perfectly at liberty to exert its own voluntary motions, and can either retire into the common receptacle, or push itself out from thence and expand its curious members, without interfering with or disturbing its companions.

"They dwell together from the number of ten to fifteen, (seldom exceeding the latter or falling short of the former number), in a filmy kind of mucilaginous or gelatinous case, which out of the water has no determined form, appearing like a lump of slime, but

when expanded therein, resembles nearly the figure of a bell with the mouth upwards; and is usually about the length of half an inch, and one quarter of an inch in breadth or diameter. This case being very transparent, all the motions of its inhabitants may be discerned through it distinctly. It seems divided internally into several apartments, or rather to contain several smaller *sacculi*, each of which incloses one of these animals. The openings at the tops of these *sacculi* are but just sufficient to admit the creature's head, and a very small part of its body, to be thrust out beyond them, the rest remaining always in the case. The animal can, however, when it pleases, draw itself entirely down within the case, which is an asylum to secure it from its enemies, (for it is not unlikely many of the larger aquatic insects prey upon it,) and a safe and agreeable retirement wherein to perform the functions of digestion, sleep, and the other necessary calls of nature. This case it can, I say, retire into at pleasure; and it never fails to do so when any sudden motion of the water or of the vessel it is in disturbs it: as also when it has seized with its arms any of the minute insects which serve for its food.

"The arms are set round the head to the number of forty, having each the figure of a long *ſ*, one of whose hooked ends is fastened to the head; and all together when expanded compose a figure somewhat of a horse-shoe shape, convex on the side next the body, but gradually opening and turning outwards, so as to leave a considerable area within the outer extremities of the arms. And when thus extended, by giving them a vibrating motion, the creature can produce a current in the water, which brings the animalcules, or whatever other minute bodies are not beyond the sphere of its action, with great velocity to its mouth, whose situation is between the arms, where they are taken in if liked, or else by a contrary current, which the creature can excite, they are carried away again; whilst at the same time other minute animalcules or substances, that by lying without-side the inclosure made by the arms are less subject to the force of the stream, are frequently seized by them: for their sense of feeling is so exquisite, that on being touched ever so slightly by any such little body, it is caught immediately and conveyed to the mouth. However, one may observe the creature is sometimes disappointed in its acquisition, for after drawing down one of the arms suddenly inwards towards the mouth, it may be perceived slowly extending itself again without the creature's retiring into its case; which it fails not to do on meeting with anything worth the while.

"The food is conveyed immediately from the mouth or opening between the arms, through a very narrow neck, into a passage seemingly correspondent to the œsophagus in land animals; down which it passes to the stomach, where it remains for some time, and then is voided upwards in small round pellets (which at first I imagined to be its eggs) through the gut, whose exit is near a neck, where it was first taken in.

"The body of this animal consists of three parts or divisions, in the uppermost whereof all the aforementioned intestines are contained, though they are not to be distinguished when the creature is hungry; but after it has eaten they become distended and opake, and may very plainly be discovered. The other two divisions (the lowermost of which I take to be fixed to the bell or outward case) seem of no other service than to give the creature power of contraction and extension.

"The arms seem not able, like those of the common polype, to contract or shorten themselves; but instead thereof, when the animal retires into his case, they are brought together in a close and curious order, so as easily to be drawn in. Their general figure when expanded is that of a cup, whose base and top are of an horse-shoe form; but they present sometimes a very different appearance, by separating into four parts, and ranging themselves in such sort as to represent four separate plumes of feathers.

"I could never discover any eyes they have, and yet find some reason to believe they see; for on being set in the light of the sun, or a candle, or brought out of the dark into daylight, though contracted before and retired into the bell (as indeed they generally are when in the dark), they constantly extend their arms for prey, and show evident signs of being pleased.

"Besides the particular and separate motion each of these creatures is able to exert within its own case and independent of the rest, the whole colony has together a power of altering the position, or even of removing from one place to another the bell or common habitation of them all. Hence this bell is seen sometimes standing perfectly upright, sometimes bending the upper part downwards.

"It has been mentioned already, that between ten and fifteen of these animals dwell together, as it were a little community, in one bell-like case or common habitation: but their number increasing, this bell may be observed to split gradually, beginning from about the middle of the upper or anterior extremity, and proceeding downwards towards the bottom, till they separate at last entirely, and form

two complete colonies, independent of each other, one of which sometimes removes itself to another part of the vessel. The manner how the single animals propagate I have not been able to discover, though there is some reason to conjecture it may be by the means of eggs; as small opake bodies of a constant and determinate figure are sometimes seen lying in their bells; and unless they are eggs, I know not what to make of them. Their shape is nearly that of a weaver's shuttle, being composed of two circular arcs, whose concave parts are towards each other. The breadth is about two-thirds of the length, and in the middle of each a circular spot appears more opake than the rest, which possibly may be the embryo. But, as I never saw any of them come to perfection, I can make no further judgment of them than what their situation and form suggests.

"The bells or colonies of these animals are to be found adhering to the large leaves of duckweed and other aquatic plants; and may easiest be discovered by letting a quantity of water with duck-weed in it stand quietly for three or four hours in glass vessels, in some window or other place where a strong light comes; for then, if any are about the duck-weed, they will be found on careful inspection extending themselves out of their cases, spreading their plumes, and making an elegant appearance.

"They are extremely tender, and require no little care to preserve them: their most general disorder is a kind of slime or mouldiness, which will sometimes envelope them in such a manner as to prove mortal. The best way of curing this is by gently pouring a large quantity of water (perhaps two or three quarts) into the vessel where they are kept, and letting it run off slowly; by which means the sliminess will gradually be loosened and carried away with the water.

"As to food, if fresh water be given them daily, they will find sufficient for themselves; and it is dangerous to try any other way of feeding them, for the smallest worms or other visible insects one can think of giving them will tear their delicate frame in pieces."

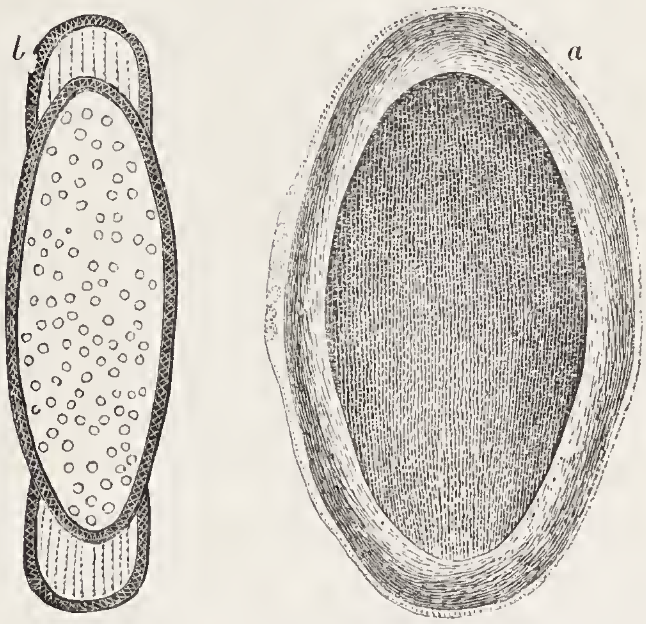
Pallas has added nothing to the history of this polype, which he had, nevertheless, personally examined. Bosc, having collected, in ponds near Paris, a polypidom of a massive character, apparently unknown, sent it to Bruguière, who described it as a new species of Alcyonium. The same production having come under Lamarck's inspection, he formed of it the genus Alcyonella, which was immediately adopted by all naturalists, for Bruguière's description of the

polypes (the accuracy of which was vouched for by Lamouroux !) differed in so many obvious particulars from Trembley's, that no one could suspect their identity, the more especially as the figures of the polypidoms were equally dissimilar. Bosc's polypidom was therefore catalogued in our systems as an Alcyonella, and Trembley's as a species of Plumatella. Thus matters stood when Raspail was led, in 1826 and 1827, to examine the subject, and the result of his ingenious labours has been very curious, though some of his conclusions, notwithstanding the boldness of their enunciation, seem to me unproved, and one of them, which identifies the Cristatella with the Alcyonella, has already been shewn to be erroneous. He has, however, demonstrated very satisfactorily the entire sameness of the Polypes à Panaches of Trembley, the Bell-Flower Animal of Baker, and the Alcyonella of Lamarck,—the variations in the polypidom, which had deceived all others, being produced by age, or by external and fortuitous circumstances, as, for example, by peculiarities in its site : when this is the floating leaves of Lemnæ, or the upper or under side of a stone, the development is diffused, or lobed, or arborescent, or creeping, or massive and spongy, according as the polypidom has freedom to spread, or is restrained by its position, or is influenced by the mere gravitation of one part against another. I can find, however, in the beautiful series of figures which illustrate his Memoir, none to make me assent to Raspail's opinion that all the Plumatellæ are *certainly* mere variations of this zoophyte: at present the facts appear rather of an opposite tendency ; while, on the contrary, subsequent observations have shewn that he is right in considering as embryo Alcyonellæ the Leucophra heteroclita and Trichoda floccus of Müller, as well perhaps as the Difflugia protæiformis of Leclerc, although Ehrenberg declares against this conclusion.

Raspail's description of the zoophyte is admirable, and is rendered peculiarly interesting from the generalizations in physiology which the author ever and anon boldly hazards on certainly a very narrow basis ; and the curious experiments detailed in it. He has fully recognized the merits of Trembley, and has confirmed his accuracy in most particulars ; he has explained the cause which led Trembley erroneously to ascribe a retractor muscle to the body, the appearance being the result of a fold or plait in the tunic in certain positions of the body ; he ascertained the position of the anus ; gave a complete view of the tentacular apparatus, and an inimitable anatomy of the ova, which we shall transcribe at least in part. The ova, he says, are in general one-third of a millimetre in their longest diameter.

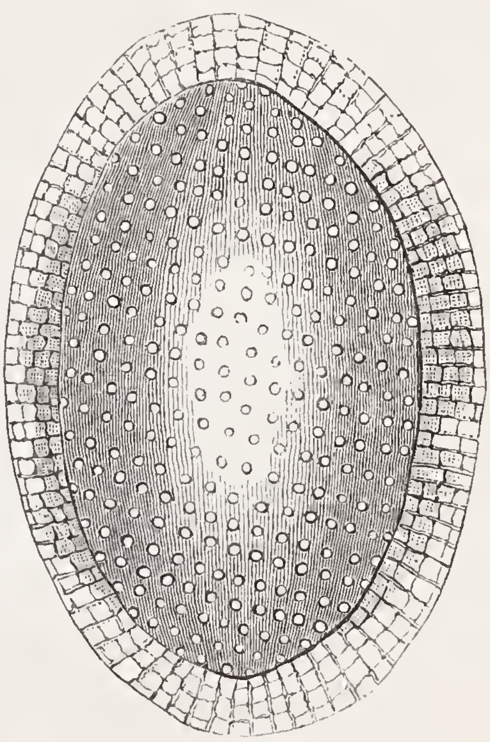
On each of the two parallel faces we distinguish a shield, a little convex, and of the same shape as the egg itself, surrounded with a rim of the same colour and consistence. (Fig. 74, *a.*) In drying,

Fig. 74.



these two faces approximate and become concave, while the rim remains unaltered. A section perpendicular to the two faces shews that the rim has no communication with the shield (Fig. 74, *b*); that it is distended with a cellular tissue of the same substance as the parietes; and that the shield encloses, under a shell of the same nature as the rim, a glutinous cellular tissue, the cells of which are filled with transparent, apparently amylaceous, granules, spread in myriads over the object-glass when the perisperm is torn. The most minute observation has been employed without success in finding any indication of an organ analogous to the embryo.

Fig. 75.



By a section parallel to the two faces, the difference which exists between the structure of the rim and shield is made apparent. Of the former, the coat, deprived of the tissue which it contains, is seen to be transparent, and divided into cellules arranged in rays which point towards the centre of the organ; while the resinous and woody thickness of the shield presents a great number of small globular yellowish

cells disposed in quincunx. (Fig. 75.) This arrangement becomes still more apparent on boiling the ovum in alcohol, which however, no otherwise than ether, does not seem to discolour it much. Its brown colour is not owing to the presence of iron, for a long soaking of the eggs in prussiate of potass sharpened with sulphuric acid has not communicated the slightest tint of blue to their surface, even when they have been bruised previous to the maceration. Alcohol changes to a golden yellow the original brown colour of the shield. Iodine does not colour, or only colours to a faint yellow, the granules of the perisperm, which their appearance suggested to be amylaceous; but alcohol separates from them a fatty substance, for, in spontaneous evaporation, this menstruum deposits on the object-glass a white layer over which water glides without raising any thing from it.

On examining by refraction one of the eggs with a magnifier of one hundred diameters, very often another transparent narrow margin becomes visible, which overlaps all the circumference and indicates an external envelope of extraordinary delicacy. On one side of this there is to be distinguished an evident trace of the old adhesion of the egg to the walls of the tubes which enclosed them,—a point which may be called the *hilum*. Very often, however, this delicate tunic may be sought for in vain on other eggs.*

32. Plumatella,† Bosc.

Character.—*Polypidom fixed, membranaceous, confervoid, tubular, branched: Polypes issuing from the extremities of the branches; tentacular disc of a crescentic form; tentacula numerous (about* 60), *arranged upon the margin of the disc in a single series, invested at their origin by a membrane.* Allman.

1. P. repens, *polypidom adhering, the erect branches tubular with an entire aperture.* (Fig. 76.) Rev. Dr. Fleming.

Tubipora repens, *Lin.* Syst. edit. 10, 790.—Tubularia repens, *Mull.* Verm. i. ii. 16. Zool. Dan. prod. 254. *Bosc* Vers, iii. 93.—Tub. reptans, *Turt.* Gmel. iv. 669.—Plumatella repens, *Lam.* Anim. s. Vert. ii. 108: 2de edit. ii. 123. *Flem.* Brit. Anim. 522. *Stark* Elem. ii. 441. *Landsborough* in Scot. Christ. Herald, n. s.

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* Van Beneden has published a Memoir on the Alcyonella which I have not seen. He finds in the same polype-mass male and female polypes. The embryo young are in a free and isolated state, have a very rapid motion produced by cilia, and simulate Planariæ. See Microsc. Journal, ii, 146.

† The diminutive of *plumata*—plumed.

1, 727. *Hassall* in Ann. and Mag. N. Hist. x, 153. *G. J. Allman* in Proc. R. Irish Acad. an. 1843. *W. Thompson*, in Ann. Nat. Hist. v, 254. *Allman* in Ann. and Mag. N. Hist. xiii, 330.—Naisa repens, *Lamour.* Coral. 98.*

Fig. 76.

Hab. "On the under side of stones. Lochmill-loch, Fife," *Fleming.* "Not unfrequent in a rivulet of beautifully clear water, at Norton, in the county of Durham," *John Hogg, Esq.* In a small quarry pond in the parish of Stevenston, Ayrshire, *Rev. D. Landsborough.* In rejectamenta on the shores of Lough Erne, Sept. 1837, *W. Thompson.* Near Glasgow, *Dr. Scouler.* In a pond in the vicinity of Cheshunt, *A. H. Hassall.* Bandon, Glandore, Dublin, *G. J. Allman.*

"Stem extending several inches, irregularly branched, slightly enlarging towards the aperture, dilatable; tentacular margin divided into two lobes, tentacula ciliated in opposite directions. Besides a gullet, stomach, and gut, there is a distinct rectum, terminating in a tubular orifice seated externally to the tentacular margin, out of

* To this synonymy it may be useful to add the following, communicated to me, along with a dried specimen of the polypidom, by J. Hogg, Esq. "A small piece of it is figured in *Schæff.* Armpolyp. tab. i. fig. 1, 2, published in 1754. The next representation of it is in tab. 19, fig. 1—5, in the Bulletin Philomatique (not Bull. des Sciences Nat.) p. 157, no. 81, an 12 (de la Republique) = 1804, belonging to an extract from a memoir by Vaucher on the fresh-water Tubulariæ : there fig. 1. much resembles the polypary in its natural state, but the animal magnified is not near so like as that figured in the former work : however neither plates do justice to the polypes."

which I have witnessed the remains of the food swallowed but a short time before forcibly ejected." *Fleming.*

As I have already stated, Raspail considers the Plumatellæ to be merely states of the Alcyonella,—an opinion which future inquiries may shew to be true, but at present there are some difficulties in the way of its adoption. Lamarck perceived the affinity of the genera, which he nevertheless kept separate, resting the distinction on the massive and ramous forms of the polypidoms. Baër, apparently speaking from personal examination of the production in question, has expressed his conviction of the perfect distinctness of Alcyonella and Plumatella, and this subsequently to his knowledge of Raspail's Memoir: and Milne-Edwards has still more recently shown that this Essay had at least not conveyed perfect conviction to his mind, otherwise he would scarce have expressed himself in this manner: "Il nous parait en effet probable que ces Polypes, observés à des périodes diverses de leur développement, ont été pris pour des animaux differens et décrits sous des noms particuliers. Mais il serait possible aussi que les formes transitoires de l'Alcyonelle décrites par M. Raspail se rencontrassent d'une manière permanente chez d'autres Polypes, et par conséquent, on ne peut encore rayer des catalogues zoologiques la longue suite d'espèces mentionnées ci-dessus." Lam. Anim. s. Vert. 2de edit. ii. 116.—Under these circumstances I have deemed it the best course to keep the genera separate, as least likely to perplex the student; although aware that the observations of Mr. Hassall are much in favour of Raspail's view. See Ann. and Mag. N. Hist. x, 153.

2. Pl. emarginata, "*polypidom cylindrical, closely adherent in the greater part of its extent, but sending off several short free branches, about half an inch in length; margins of apertures with a deep notch, which is filled up by a transparent membrane.*" Allman.

Plumatella emarginata, *Allman* in Ann. and Mag. N. Hist. xiii. 331.

Hab. Fresh water. Bandon, Dublin, *G. J. Allman.*

3. Pl. fructicosa, "*polypidom shrubby, adherent in but a small part of its extent, suddenly dilated towards the apertures; margins of apertures entire.*" Allman.

Plumatella fruticosa, *Allman* in Ann. and Mag. N. Hist. xiii, 331.

Hab. Fresh waters. Bandon, Glandore, Dublin, *G. J. Allman.*

33. Fredericella,* P. Gervais.

Character.—"*Polypidom fixed, coriaceous, tubular, branched. Polypes issuing from the extremities of the branches; tentacular disc orbicular; tentacula arranged on the margin of the disc in a single series, less numerous than in Plumatella (about* 24), *invested at their origin by a membrane.*" Allman.

1. F. sultana, *the erect polype-tubes cylindrical.* Rev. Dr. Fleming.

Tubularia sultana, *Blumenb.* Man. 272, pl. 1, fig. 9. *Bosc* Vers, iii, 93.—Plumatella gelatinosa, *Flem.* Br. Anim. 553.—Fredericella sultana, *Allman* in Ann. and Mag. N. Hist. xiii, 331. *W. Thompson* Rep. Brit. Assoc. 1843, p. 285. *Couch* Corn. Faun. iii, 135.

Hab. Lochmill-loch, Fife, *Fleming.* Near Foulden, Berwickshire, *Sir J. G. Dalyell, Bart.* On the weeds in the ponds at Trengwainton, near Penzance common, *R. Q. Couch.* Bandon, Dublin, *G. J. Allman.*

"Height about two inches, tufted, shrubby; stem dichotomously branched, scarcely enlarging at the extremity; polypi with a bell-shaped disc, the tentacula regularly disposed, and appearing as if webbed at the base; mouth with a valve." *Fleming.*

2. F. dilatata, "*polypidom dilated towards the apertures.*" Allman.

Fredericella dilatata, *Allman* in Ann. and Mag. N. Hist. xiii, 331.

Hab. Fresh waters. Dublin, *G. J. Allman.*

FAMILY—PALUDICELLAIDÆ.

34. Paludicella,† Gervais.

Character.—"*Polypidom fixed, coriaceous, consisting of a single series of claviform cells with a catenulated arrangement; apertures unilateral, tubular, placed near the wide end of the cell. Tentacular disc of polypes orbicular, bearing upon its margin a single series of tentacula; tentacula free.*" Allman.

1. P. articulata. (Fig. 77.) W. Thompson.

Paludicella articulata, *G. J. Allman* in Proc. Roy. Irish Acad. an. 1843, with a plate Ann. and Mag. N. Hist. xiii, 331.

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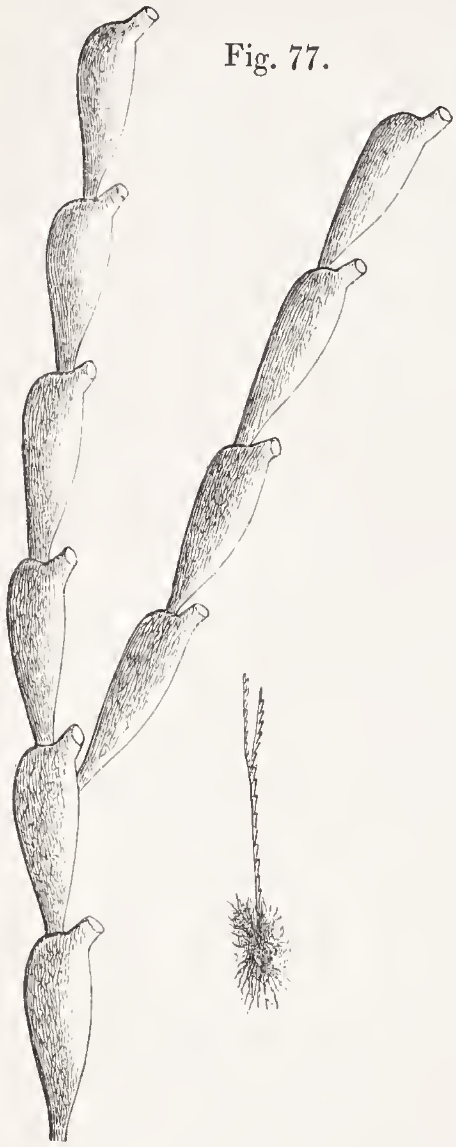
* Name in honor of *Frederick* Cuvier.

† Formed from *palus*, a marsh, and *cella*, a cell.

Hab. Lough Erne, found in September 1837, *W. Thompson.* Discovered in the Grand Canal near Dublin, in October 1842, *G. J. Allman.*

Fig. 77.



Polypidom entirely membranous, confervoid, filiform, diffusely and irregularly branched, of an olive-green colour, consisting of a single series of cells, catenated together and separated only by a joint at their origins: cells oblong, narrow at the base and widening upwards, smooth and even, semipellucid, the aperture subterminal and lateral, forming a short narrow tube with an even rim.

This singular zoophyte has been well figured and described by Professor Allman. The polype is ascidian, and appears to have a crown of about twenty-six ciliated tentacula arranged in an uninterrupted circle. Professor Allman's paper in the Proceedings of the Royal Irish Academy, is printed as a separate pamphlet with the title—" On the muscular system of Paludicella articulata, and other Ascidian Zoophytes of fresh water." Dublin, 1843.

HISTORY OF ZOOPHYTOLOGY.

"In nova fert animus mutatas dicere formas
Corpora."—Ovid. *Metamorph.* i.

The natural productions which have so long occupied our attention, were denominated Zoophytes because, according to some physiologists, they partook of the nature both of vegetables and animals, and connected the two kingdoms of organized matter; or because, as others defined the term, having the outward semblance of sea-plants, they were in reality the formations of little animals or polypes that nestled in the cells or tubes of the zoophyte, to which they were organically and indissolubly connected.

Little more than a century has elapsed since the first discoveries were made, on which these opinions are founded.

Previously to that time zoophytes were considered the undoubted subjects of the vegetable kingdom, naturalists being obviously led to this allocation of them by their arborescent appearances, in which it were vain to trace any likeness to any common animal forms,—and by their permanent fixedness to the objects from which they grow, for zoophytes are attached by means of a disc or tubular fibres much in the same way that marine plants are, while the capability of moving at will from place to place was deemed to be the principal character of distinction between the two classes of animated beings. The zoologist claimed none of them, if we except the Actiniæ or animal-flowers, for his province and study, but left them without dispute to botanical writers; and if any of these, in reference to a very few zoophytes of the least arborescent character, hazarded a whispered conjecture that they were wrongly classed, it died away in the utterance, and raised no echo to awaken further inquiry. The only opposition to the botanical theory came from the mineralogists, who some of them questioned the vegetability of such of these productions as were of a hard and stony nature, contending that they were rather rocks or stones formed by the sediment and agglutination of a submarine general compost of calcareous and argillaceous materials, moulded into the figures of trees and mosses by the motion of the waves, by crystallization, by the incrustation of real fuci, or by some imagined vegetative power in brute matter. But although not more—perhaps less repugnant to the outward sense than the opposite hypothesis, yet the mineral theory seems at no time to have obtained very general favour or credit; and accordingly we find that, in the works of Tournefort and Ray,* the leading naturalists of the age immediately antecedent to the discoveries which led to the modern doctrines, the zoophytes, whether calcareous and hard,

* In his "Wisdom of God in the Creation," Ray has, however, reckoned the *Lithophyta* among "inanimate mixed bodies." Of these, he says, "some have a kind of vegetation and resemblance of plants, as corals, pori, and fungites, which grow upon the rocks like shrubs."—p. 83, duod. Lond. 1826. His opinions on this point were probably unsettled; and certainly many naturalists believed that Ovid only expressed the simple fact when he wrote—

> "Sic et curalium, quo primum contigit auras
> "Tempore durescit; mollis fuit herba sub undis."
>
> Metam. lib. xv.

or horny and flexible, were arranged and described among sea-weeds and mosses without any misgivings concerning the propriety of doing so.

Ferrante Imperato, an apothecary in Naples, was the first naturalist, according to M. De Blainville, distinctly to publish, as the result of his proper observations, the animality of corals and madrepores,* and he is said to have accompanied the descriptions of the species which fell under his notice with illustrative figures of considerable accuracy. His "Historia Naturale," of which De Blainville assuredly speaks in very exaggerating terms when he represents it as one of the most important works in the history of zoophytology, was printed at Naples in 1599; but although reprinted some years afterwards (1672), the book, and the knowledge it contained, had sunk into such complete oblivion, that when Jean-André Peyssonnel, in the year 1727, communicated the same discovery to the Academy of Sciences in Paris, it was received by the members of that learned body in a manner which is sufficient to convince us that it was entirely new to them, and exposed the author to the obloquy and censure which are the usual portions of an original discoverer.

Some time previously to the publication of Peyssonnel's discovery, those who maintained that the stony zoophytes

* Man. d'Actinol. p. 14.—Lamouroux, on the contrary, places Imperato on the same level with Gesner, Boccone, and Shaw—none of whom had any distinct notion of the animality of *any* zoophytes, and had no doubt of the vegetable nature of almost all of them. "Les observations de ces hommes célébres, au lieu d'éclairer les naturalistes sur cette branche intéressante de la science, embrouillaient encore plus son étude." Lam. Cor. Flex. Introd. p. xiv.—My copy of Imperato's work is of the edition printed at Venice in 1672, folio. It is written entirely in Italian, and, being ignorant of that language, I can give no opinion of the value of its letter-press. The only copper-plate is a very curious one, representing the interior of Imperato's museum, which appears to have been a very elegant and copious collection of curiosities, a servant pointing with a rod and directing the attention of two wondering visitors to the more remarkable of them, while a third leans against a cabinet, and surveys,

"———— not without much content
"Its many singularities."

The book contains, besides, many wood-cuts of a miscellaneous kind, very tolerably engraved for the age. The Zoophytes figured belong chiefly to the Lithophyta, with some Sponges and Alcyonia. The opinions of Rumphius seem to have been as explicitly stated as those of Imperato, but they effected nothing.—Pall. Elench. 14, and 275.

were plants, had received a strong corroboration of their opinion from the elaborate researches of the Comte de Marsilli, who, having detected the existence of polypes in coral and madrepore, had, under the influence of the fashionable theory, described them as being literally their blossoms or flowers.* Peyssonnel, therefore, had to contend not only against the prejudices of the vulgar based on appearances which spoke direct to the outward sense, but against the actual observations of a naturalist of acknowledged merit; and the counter observations of Peyssonnel, although numerous and unequivocal, were yet mixed up with so much that was fanciful or erroneous, that it is not wonderful his opinion was received with coldness and suspicion. Reaumur, to whom his communication was intrusted, even concealed the name of the author when he laid it before the Academy, with the benevolent intention doubtless of shielding him from the scorn and ridicule that might possibly be the lot of one who had ventured to contradict the observations of an Italian Count, and to oppose the established belief;† and he immediately afterwards read, before the same academicians, an essay of his own, in which he opposed the theory of Peyssonnel with numerous objections, and attempted to explain the growth of coral in accordance to the admitted principles of vegetable physiology.‡

The memoir in which Peyssonnel originally proposed his doctrine, does not appear to have been published: the only account I have seen of it is contained in the essay of Reaumur,

* "Ce fut une découverte qui fit grand bruit dans le monde naturaliste, que celle des fleurs du corail." Reaumur.—Marsigli's work was published in 1711. His name is sometimes written *Marsilli*.—For an account of his works see Haller, Bib. Bot. i. 630; and the reader will find a rapid sketch of his adventurous life in Cuvier's Hist. des Sc. Nat. iii. p. 330—2.

† "L'estime que j'ai pour M. Peyssonnel me fit même éviter de la nommer pour l'auteur d'un sentiment qui ne pouvoit manquer de paroître trop hasardé." Reaumur.

‡ Observations sur la formation du corail, et des autres productions appellées Plantes pierreuses. Par M. de Reaumur.—" Il prend pour une Plante l'ecorce grossiere et sensible du corail, tres-distincte de ce que nous appellons corail, et de plus une autre ecorce beaucoup plus fine, et que les yeux ne distinguent point de la vraye substance coralline qu'elle revêt; et tout le reste du corail, presque toute la substance coralline n'est qu'une pierre sans organisation." Hist. de l'Acad. Roy. des Sc. 1727, p. 51; and more particularly his own memoir in the same vol., p. 380.

just alluded to. He maintained that what Marsigli had described as the blossoms of coral, were true animals or insects analogous to the Actiniæ or sea-anemones; that the coral was secreted in a fluid form by the inhabitant Actiniæ, and became afterwards fixed, hard, and changed into stone; and that all other stony sea-plants, and even sponges, are the work of different insects, particular to each species of these marine bodies, which labour uniformly according to their nature, and as the Supreme Being has ordered and determined. Reaumur remarks, that these opinions were not entirely the offspring of fancy; it would have been more candid and just had he said they were simply the convictions of a practical naturalist, who had long and patiently studied the productions in question, in their native sites on the coasts of France and of Barbary. Peyssonnel had seen the polypes of coral and of the madrepores; he recognised their resemblance to the naked animal flowers; he had witnessed their motions,—the extension of their tentacula, and the contraction and opening of the oral aperture; he ascertained that, unlike flowers, they were to be found the same at all seasons; that their corruption exhaled the odour; their chemical analysis discovered the constituent principles of animal matters; and that the stony part of them exhibited no trace of vegetable organization: and opinions deduced from such data, abstracting his analogical reasoning of no value and little applicability, might have been sufficient to have attracted at least some attention had his opponent been less influential, or his own reputation and rank somewhat greater.*

The name and doctrine of Peyssonnel lay in this manner

* Peyssonnel is remembered solely by this discovery. "M. Peyssonnel, disposed from his youth to the study of natural history, after having qualified himself for the practice of medicine, applied himself with great diligence to that science, to which his inclination so strongly prompted him, and being a native of, and residing at Marseilles, he had the opportunity of examining the curiosities of the sea, which the fishermen, more especially those who search for coral, furnished him with." Phil. Trans.—He was subsequently appointed Physician-Botanist to "His Most Christian Majesty" in the island of Guadalupe, and had an opportunity of prosecuting his researches on the coast of Barbary. He is the author of two or three communications in the Phil. Trans., of which the most interesting is "An account of a visitation of the Leprous persons in the isle of Guadalupe" in the volume for the year 1757. Very recently a genus of the Algæ—*Peyssonnellia*—has been deservedly devoted to his memory.

unknown and neglected, until the remarkable experiments of Abraham Trembley, in 1741, on the reproductive powers of the fresh-water polypes,* and more especially his discovery of the Plumatella, itself a plant-like animal production, while they extorted the wonder and admiration of every one engaged in the study of natural science, were the means of recalling to the recollection of Reaumur the views of Peyssonnel; and he now became forward in promoting such inquiries as seemed likely to confirm and extend them. He himself appears to have repeated the experiments of Trembley, and had an opportunity of observing the habits of the Plumatella; and, as he remarks, since the number of species of animals which are covered by the waters of the sea is much greater than that of the fresh waters, so it seemed natural to presume that not only would polypes be found in the ocean, but in greater numbers and variety than in ponds, rivers or rivulets. To ascertain the validity of this conjecture, and to settle if possible the discrepancy between the observations of Marsigli and Peyssonnel, his friends Bernard de Jussieu and Guettard† proceeded, in the autumn of 1741 and 1742, to different parts of the coasts of France with the view of examining their zoophytical productions; and both were soon satisfied of the truth of the animal theory. Bernard de Jussieu in particular shewed that it was equally applicable to many zoophytes which Peyssonnel had not examined, and whose animality had not yet been suspected, viz. the flexible and delicate Sertulariæ, the Flustra, and the Alcyonium or Lobularia, the last of which seems to have excited much astonishment by the protrusion of its thousands of polypes of a size large enough to be seen and examined at ease with the naked eye.‡

The memoir which Jussieu presented to the Academy of Sciences in Paris is short, but characterized by great distinctness and precision in the detail of his observations, and illus-

* In the Phil. Trans. for 1742, the reader will find a full account of this discovery.

† Lamouroux speaks highly of the labours of this naturalist, whose attention seems to have been chiefly directed to fossil polypidoms and to sponges. Corall. Flex. Introd. p. xvii. See also Hall. Bib. Bot. ii. 341.

‡ Examen de quelques productions marines qui ont été mises au nombre des Plantes, et qui sont l'ouvrage d'une sorte d'Insectes de mer. Par M. Bernard de Jussieu. 14th Nov. 1742. Published in 1745.—See Hall. Bib. Bot. ii. 281.

trated with excellent figures;—his aim being evidently not to entrap our blind assent by a declamatory display of the new wonders opened up in science, but to prove his conclusion to be the true one in the eye of reason and sobriety. He limits his descriptions and remarks to four species, viz. Alcyonium digitatum, Tubularia indivisa, Flustra foliacea, and Cellepora pumicosa, which seem to have been selected as examples of the more remarkable tribes, for it is evident that he had examined many more, but his observations on them were reserved for another memoir, which, I believe, was never written.*—Reaumur's advocacy of the new doctrine was in a more popular style, but not the less excellent. He gave a short exposition of the ascertained facts,—reviewed with the clearness of an eye-witness the discoveries of Trembley,—pointed out their relations to the experiments of Jussieu and Guettard, and how they mutually lent and borrowed strength,—palliated and explained away his former opposition to Peyssonnel,—and declared his complete faith in the animality of Zoophytes, and his conviction that a numerous list of productions hitherto unexamined would be found to be of the same nature. "All

* That Jussieu had ascertained the animality of the Sertulariadæ is, I think, indisputable from the following passage. "Il s'en presentoit ensuite quantité de celles qu'on appelle Corallines, les unes pierreuses dans lesquelles je ne remarquai rien, et les autres dont les tiges et les branches, et ce qui passoit pour feuilles, etoient d'une apparence membraneuse, dans lesquelles je decouvris que ce qu'on y prenoit pour feuilles disposées alternativement, ou dans un sens opposé, n'etoit autre chose que de petits tuyaux contenant chacun un petit insecte." Mém. de l'Acad. Roy. des Sc. an. 1742. p. 292.—Reaumur is still more explicit: "Après avoir observé dans l'eau même de la mer plusieurs espèces de ces productions si bien conformées à la manière des plantes, il vit sortir des bouts de toutes leurs branches et de tous leurs nœuds, ou de toutes leurs articulations, de petits animaux qui, comme les polypes à panache d'eau doucese donnoient tantôt plus, tantôt moins de mouvement, qui comme ceux-ci s'épanouis, soient en certains temps, et qui dans d'autres rentroient en entier dans leur petite cellule, hors de laquelle leur partie postérieure ne se trouvoit jamais. Enfin, il (B. de Jussieu) reconnut que plusieurs espèces de ces corps, dont chacun avoit l'extérieur d'une très-belle plante, n'étoient que des assemblages d'un nombre prodigieux de cellules de polypes; en un mot, que plusieurs de ces productions de la mer, que tous les botanistes que les ont décrites ont prises pour des plantes et ont fait représenter comme telles avec complaisance, n'étoient que des polypiers." Preface, Vol. vi. p. 71, 72.—See also Amoenitates Academicæ, Vol. i. p. 185, for an enumeration of the species of Sertularia, &c., which Jussieu had examined, and considered to be animal productions. His account, however, of the animal of the Sertulariæ is altogether erroneous.

that we have said," he thus concludes, "of the polypes of the sea, is merely a sort of advertisement, which however cannot fail to produce the effect which we promise ourselves from it; it will direct undoubtedly the curiosity of naturalists who reside by the sea to insects so worthy of being better known. They will seek out the different species; they will delight to describe to us the varieties, presented in their forms never but remarkable; they will study the figure and disposition of the cells of the various species, their manner of growth and reproduction, and wherewithal they are nourished; they will, in short, place in a clear light every thing that has reference to the different polypidoms and their formation, so that a department of natural history, so interesting, so new, and as yet only sketched in outline, may be rendered as perfect as it merits to be."*

The appeal, eloquent as it was, and from one having great influence, was however made in vain; for whether from the inveteracy of habit and our fondness of opinions long cherished, or from the fewness of the published observations whence the general conclusion was drawn, it seems certain that the new doctrines were everywhere received with doubts and suspicion, and, beyond the immediate sphere of the Parisian academy, excited apparently so little interest, that no one was induced to enter into a practical examination of them. Donati, indeed, shortly after gave a minute and accurate description of the coral and its polypes, and a somewhat less detailed one of the madrepores, but his phraseology being botanical and his opinions unformed,† his researches were of little immediate service to the cause of the zoologists, and

* Mémoires pour servir à l'histoire des Insectes, Tome sixième, Paris, 1742. Quarto. Preface, from p. 68 to p. 80.

† Shortly after this, however, he made other observations which convinced him of the animality of coral. He says—"I am now of opinion, that coral is nothing else than a real animal, which has a very great number of heads. I consider the polypes of coral as the heads of the animal. This animal has a bone ramified in the shape of a shrub. This bone is covered with a kind of flesh, which is the flesh of the animal. My observations have discovered to me several analogies between the animals of kinds approaching to this. There are, for instance, Keratophyta, which do not differ from coral, except in the bone, or part that forms the prop of the animal. In the coral it is testaceous, and in the Keratophyta it is horny."—Phil. Trans. (1757) abridg. xi. p. 83.

perhaps rather tended to support the erroneous hypothesis which they were combating.*

Peyssonnel was still living, and it was impossible that this discussion should not interest him. Accordingly we find that in 1751, he transmitted to the Royal Society of London a manuscript treatise on coral and other marine productions,† of which Dr. Watson has given a review in the 47th volume of its Transactions, published in 1753. The treatise was sent to the English society, because, "that in France some lovers of natural history do attribute and even appropriate to themselves his labours and his discoveries, of which they have had the communication;"—a charge probably directed against Reaumur, but which the conduct of that illustrious man, so far as appears, did not warrant. The treatise contains upwards of 400 quarto pages, and is the result of the observations of above thirty years, but we find in it no facts in support of his theory additional to those already mentioned, for the greater portion of it is occupied with many details on the medical uses and other applications of coral which have no relation to the question at issue.‡ It seems at first to have excited considerable attention among the members of the Royal Society, but Peyssonnel's endeavours were doomed ever to be unfortunate, for such favour as his theory was likely to receive here was nipt in the bud by the opposition of Dr. Parsons, a naturalist of considerable eminence, and an active member of the society. The analysis of Peyssonnel's treatise was read in May 1752, and in June of the same year

* New Discoveries relating to the History of Coral, by Dr. Vitaliano Donati. Translated from the French, by Tho. Stack, M.D., F.R.S., (Feb. 7, 1750).—Phil. Trans. Vol. xlvii. p. 95. Haller characterizes the original as "nobile opus, ex proprio labore natum."—Bib. Bot. ii. 400. See also Cuvier's Hist. des Sc. Nat. iii. p. 335.

† Traité du corail, contenant les nouvelles decouvertes, qu'on a fait sur le corail, les pores, madrepores, scharras, litophitons, éponges, et autres corps et productions, que la mer fournit, pour servir à l'histoire naturelle de la mer. By the Sieur de Peyssonnel, M. D. Correspondent of the Royal Academy of Sciences of Paris, of that of Montpelier, and of that of Belles Lettres at Marseilles. This treatise was never published.

‡ M. Flourens has recently given a new analysis of this MS. treatise, of which a copy is contained in the library of the Paris Museum; and the account which Peyssonnel left in manuscript of his voyage to Barbary has been lately (1838) published. See Ann. des Sc. Nat. n. s. ix. p. 334 et seq.

Dr. Parsons read his answer,* which savours much of the supercilious dogmatism of a sceptical philosophy. He does not pretend that he had tested the doctrine of Peyssonnel by any experiments or observations, nor does he question his veracity, but he chose to consider the animals observed by Peyssonnel in the coral and madrepores as merely accidental settlers which had nothing to do with their growth,—occupants of mansions prepared for them by more active entities,—there being no "seeming power, proportion, and stability" in the polypes to render them capable of performing such works as they were thought to have done. "And indeed it would seem to me," says the learned doctor, "much more difficult to conceive, that so fine an arrangement of parts, such masses as these bodies consist of, and such regular ramifications in some, and such well-contrived organs to serve for vegetation in others, should be the operations of little, poor, helpless, jelly-like animals, rather than the work of more sure vegetation, which carries on the growth of the tallest and largest trees with the same natural ease and influence as the minutest plant."

The mineral theory also found at this period its latest advocate. Henry Baker, during his numerous microscopical enquiries, had become familiar with the beautiful and regular "vegetations" which many salts and earths assume in their crystallizations from a fluid state, and, seeing nothing more uniform or beautiful in the stony corals and corallines, he was naturally led to give an easy assent to that doctrine which taught that these were all the result of similar depositions. The new opinions might be true or not when restricted to the pliant horny corallines, (though he inclined to believe in their vegetable origin,) but it was unnecessary to call in the agency of animalcules to explain the formation of the hard stony kinds, which indeed seemed beyond the power of an almost gelatinous animalcule to excrete and laborate. Nor would he believe *these* to be sea-plants, but rather of a mineral nature and origin. "The rocks in the sea on which these corals are pro-

* A Letter from James Parsons, M. D., F. R. S., to the Rev. Mr. Birch, Secr. R. S., concerning the Formation of Corals, Corallines, &c. For an account of Dr. Parsons' writings, see Hall. Bib. Bot. ii. 340 ; and there is a short biographical notice of him in Phil. Trans. abridg. viii. 692.

duced," he says, "are undoubtedly replete with mineral salts, some whereof near their surface, being dissolved by the sea-water, must consequently saturate with their saline particles the water round them to a small distance, where blending with the stony matter with which sea-water always abounds, little masses will be constituted here and there and affixed to the rocks. Such adhering masses may be termed *roots:* which roots attracting the saline and stony particles, according to certain laws in nature, may produce branched or other figures, and increase gradually by an apposition of particles; becoming thicker near the bottom where the saline matter is more abounding, but tapering or diminishing toward the extremities, where the mineral salts must be fewer, in proportion to their distance from the rock whence they originally proceed. And the different proportions of mineral saline particles, of the stony or other matter wherewith they are blended, and of marine salt, which must have a considerable share in such formations, may occasion all the variety we see. Nor does it seem more difficult to imagine that the radiated, starry, or cellular figures along the sides of these corals, or at the extremities of their branches, may derive their production from salts incorporated with stony matter, than that the curious delineations and appearances of minute shrubs and mosses on slates, stones, &c., are owing to the shootings of salts intermixt with mineral particles: and yet these are generally allowed to be the work of mineral steams or exhalations; by which must, I think, be meant the finest particles of some metal or mineral incorporated with and brought into action by a volatile penetrating acid, which carrying them along with it into the fissures at least, if not into the solid substance of such stones or slates, there determines them to shoot into these elegant branchings; after the same manner, and frequently in the same figures, as the particles of mercury, copper, &c., are disposed and brought together by the salts in aqua fortis."*

But the progress of truth, although it may be delayed by opposition, cannot be permanently arrested. The converts to the new doctrines were indeed few, but much had been done

* Employment for the Microscope, pp. 218—220. Lond. 1753.

to facilitate their future reception, for the slumber of prejudice had been broken, the hold of the ancient opinions on the affections had been loosened, and men no longer startled into scepticism when they heard of animals that in their productions mimicked the most beautiful and delicate vegetable forms.* The mind of naturalists was thus in some measure prepared for the change on the very eve of being effected by the labours and assiduity of a member of that very society which had lately listened, with apparent approbation, to the reveries of Dr. Parsons.

John Ellis—the name of the individual alluded to—was a merchant in London, who devoted his leisure to the study of natural history, in which he attained so considerable knowledge, as to gain easy access to the Royal Society, and the acquaintance and correspondence of the most celebrated naturalists of his time. He seems to have attached himself more particularly to the economical department of botany, and seized every opportunity to introduce foreign plants to our gardens, especially such as were remarkable from furnishing any material employed in the arts and manufactures; and he was equally solicitous to acquire and diffuse accurate information relative to any natural productions which might be rendered subservient to the necessities or comforts of mankind.† He was fond also of amusing himself in making imitations of landscapes by the curious and skilful disposition of delicate sea-weeds and corallines on paper: and it was this amusement

* "For it is not because an opinion is true, that others will therefore adopt it. It must at the same time be congruous with our other impressions, and admit of being dovetailed into them, or it will be rejected, for it is judged of by its conformity to the previous acquisitions, and is disliked and condemned if incompatible with them." Turner, Sac. Hist. of the World, vol. ii. p. 19.

† "Mr. Ellis's fondness for natural history was not confined to any particular branch. Botany was likewise to him a source of infinite amusement, which he endeavoured to render useful to society in general, but more particularly to the West India islands and America. The historical account of Coffee, published by him in 1774, was designed to encourage the consumption of that article, raised by the planters in the West Indies; while the accounts of the Mangostan and Bread Fruit trees, with directions for conveying seeds and plants from the most distant parts of the globe in a state of vegetation, were published with a view to introduce those and many other plants into our settlements, where they might become beneficial to the public for the purposes of medicine, agriculture, and commerce. And his active mind was constantly employed in devising means for promoting the welfare of society until the time of his death, which happened on the 15th of October, 1776." *Mrs. Watt.*

that directed his enquiries into the nature of the latter, for, attracted by their beauty and neatness, he was induced to examine them minutely with the microscope, by the aid of which he immediately perceived "that they differed not less from each other, in respect to their form, than they did in regard to their texture; and that, in many of them, this texture was such as seemed to indicate their being more of an animal, than vegetable nature." These "suspicions," as he modestly terms them, were communicated to the Royal Society in June 1752; and, encouraged by some of the members, he prosecuted this enquiry with such ardour, and care, and sagacity, that, in August of the same year, he had fully convinced himself "that these apparent plants were ramified animals, in their proper skins or cases, not locomotive, but fixed to shells of oysters, mussels, &c., and to Fucus's."*

Ellis, however, was not forward to publish his discovery; he waited further opportunities to confirm the accuracy of his first observations, and to institute other experiments to remove whatever appeared hostile to the doctrine, which at length he fully explained to the members of the Royal Society in a paper read before them in June 1754: and it was made more generally known in the following year by the publication of his "Essay towards a Natural History of the Corallines, and other Marine Productions of the like kind, commonly found on the Coasts of Great Britain and Ireland;"—a work so complete and accurate, that it remains an unscarred monument of his well-earned reputation as a philosophical inquirer, and is even to this day the principal source of our knowledge

* See the Introduction to his Essay on the Corallines of Great Britain. It is from this work, and from the valuable "Selection of the Correspondence of Linnæus, and other naturalists, from the original manuscripts, by Sir James Edward Smith," 2 vols. 8vo. Lond., 1821, that I derive my account of Ellis's opinions. Sir J. E. Smith commences his memoir by saying, "John Ellis, F. R. S., illustrious for his *discovery* and complete demonstration of the animal nature of Corals and Corallines, was a native of Ireland." We have seen that he has no claim to this discovery, though he himself seems to have thought so, and never makes mention of his predecessors in the same field. A Professor Buttner at Gottingen, who had been in England, and become acquainted with Ellis, who calls him an "excellent botanist," unhesitatingly claimed Ellis's discoveries for his own; but a more barefaced literary theft has not been recorded, and its detection has rendered the name of the German professor infamous. Lin. Corresp. vol. i. pp. 170, 179. For a list of Ellis's writings the reader may consult Hall. Bib. Bot. ii. 433, and the introd. to Soland. Zooph. p. viii.

in this department of natural history. In several essays presented subsequently to the Royal Society, and published in their Transactions, he continued to illustrate and extend his opinions, and defended them so successfully against his opponents, that they soon came to be very generally adopted.

There was nothing unformed nor mystical in Ellis's opinion. Certain marine productions, which, under the names of Lithophyta and Keratophyta, had been arranged among vegetables, and were still very generally believed to be so, he maintained and proved, with a most satisfactory fulness of evidence, to be entirely of an animal nature—the tenements and products of animals similar in many respects to the naked fresh-water polype. By examining them, in a living state, through an ordinary microscope, he saw these polypes in the denticles or cells of the zoophyte; he witnessed the display of their tentacula for the capture of their prey, their varied actions and sensibility to external impressions, and their mode of propagation; he saw further that the little creatures were organically connected with the cells and could not remove from them, and that although each cell was appropriated to a single individual, yet was this united "by a tender thready line to the fleshy part that occupies the middle of the whole coralline," and in this manner connected with all the individuals of that coralline. The conclusion was irresistible — the presumed plant was the skin or covering of a sort of miniature hydra; a conclusion which Ellis strengthened by an examination of the covering separately, which, he said, was as much an animal structure as the nails or horns of beasts, or the shell of the tortoise, for it differs from "sea-plants in texture, as well as hardness, and likewise in their chemical productions. For sea-plants, properly so called, such as the Algæ, Fuci, &c., afford in distillation little or no traces of a volatile salt; whereas all the corallines afford a considerable quantity, and in burning yield a smell somewhat resembling that of burnt horn and other animal substances, which of itself is a proof that this class of bodies, though it has the vegetable form, yet is not entirely of a vegetable nature."*

* Dr. Good is in error when he states that the ammoniacal smell from burnt zoophytes was the *principal* fact for placing them in the animal kingdom. Book of Nature, i. 175 and 210.

Ellis taught no novel doctrine, but he gave it fixidity and currency; and he moreover applied it to those very zoophytes which possessed the vegetable appearance in the most perfection, many of which he was the first to notice, and which he illustrated with a series of figures of unequalled accuracy.* He rarely went beyond the mere statement of the facts witnessed, or what seemed an unavoidable inference from them; but, perhaps, he deserted his usual caution when, from analogy principally, he asserted that the articulated calcareous corallines (Corallina, *Lin.*) and sponges, of a very different structure from coral, madrepore, or the horny corallines, were also, like them, manifestly the places of abode of different species of polypes. In the former (Corallina) he had indeed detected some slender fibres which, it was presumed, might be parts of polypes, but this observation he was never able to confirm, and it was rather because of the porous structure of the corallines, than from any thing else, that he inferred the existence of polypes in them,—a structure which he had examined with minute accuracy, and shewn to be essentially different from any known vegetable tissue,—and, secondly, because of their chemical constituents, of which he procured an accurate analysis to be made.—With regard to the sponges, Ellis, as Peyssonnel had previously done, supposed at first that the regular holes observable in dry specimens strongly indicated their being once filled with animals; but when, after repeated examinations of recent sponge, he could detect none, this conjecture was abandoned, and so thoroughly was he afterwards satisfied of the non-existence of animalcules, that he combated the opinion of those who maintained the contrary, pointing

* As mentioned above, Bernard de Jussieu knew that the Sertulariadæ—the zoophytes here alluded to—were animal productions, but no detailed account of his observations seems ever to have been published. Trembley had made the same discovery. Dr. Watson, in his account of Peyssonnell's treatise in 1752, tells us that Mr. Trembley shewed him, "at the late excellent Duke of Richmond's," the small white polypes of the Corallina minus ramosa alterna vice denticulata of Ray, "exactly in form resembling the fresh-water polype, but infinitely less." "When the water was still, these animals came forth, and moved their claws in search of their prey in various directions; but, upon the least motion of the glass, they instantly disappeared." P. 463.—Linnæus, however, in reference to the observations made previous to Ellis, says they are "inchoatæ, non ad plenum confectæ, et desiderentur adhuc quam plurima, quæ dies forte revelabit." Amoen. Acad. vol. i. p. 186.

out where the error lay in mistaking small insects which had crept into the sponge in search of food or shelter for the real inhabitants and fabricators of the zoophyte. Yet not the less was Ellis convinced of its animality;—its chemical constituents and its structure were to him conclusive proofs of this fact, particularly when added to the signs of irritability he saw some species exhibit when in a fresh state. "I am persuaded," he writes to Linnæus, "the *fibræ intertextæ* of sponges are only the tendons that enclose a gelatinous substance, which is the flesh of the sponge. Mr. Solander and I have seen the holes or sphincters in some of our sponges taken out of the sea, open and shut while they were kept in sea-water; but discovered no animal like a polype, as in the Alcyonium manus mortui." And again: "I attended last summer in pursuit of the animals in sponges, but believe me there are none: but the whole is an animal, and the water passes in a stream through the holes, to and fro, in each papilla."*

When Ellis published these discoveries, which form in fact an epoch in the history of natural science,† Linnæus was in

* Lin. Corresp. vol. i. p. 161 and p. 163. In a subsequent letter Ellis explains himself more fully. "I am now looking into the nature of sponges, and think, by dissecting and comparing them with what I have seen recent, and with the *Alcyonium manus mortua*, that I can plainly see how they grow; without trusting to Peyssonnell's account of them, which is printed in our Philosophical Transactions, wherein he pretends to tell you that he takes the animal out of them, that forms them; and that he put it into them, and it crept about through the meanders of the sponge. This kind of insect, which harbours in sponges, I have seen; but sponges have no such animals to give them life, and to form them. Their mouths are open tubes all over their surfaces, not furnished, like the tubes of the *Alcyonium manus mortua*, with polype-like mouths or suckers. With their mouths they draw in and send out the water; they can contract and dilate them at will, and the Count Marsigli has (though he thought them plants) confirmed me in my opinion, that this is their manner of feeding. If you observe what he has wrote on sponges in his Histoire de la Mer, and the observations he has made on the systole and diastole of these holes in sponges, during the time they are full of water, you will be of my opinion. Take a lobe of the officinal sponge, and cut it through perpendicularly and horizontally, and you will observe how near the disposition of the tubes are to the figure I have given of the sections of the Alcyonium manus mortua in my plate of the Sea-Pens." Lin. Corresp. vol. i. pp. 79, 80.

† The Royal Society adjudged to Ellis the Copley medal, "as the most public mark that the Council can give of their high sense of the great accession which natural knowledge has received from your most ingenious and accurate investigations." The medal was delivered to him, Nov. 30, 1768, by Sir John Pringle, the President. Soland. Zooph. introd. p. xi. See also Swainson's "Discourse on the Study of Nat. History," pp. 38, 39.

the zenith of his reputation,—the "prince of naturalists," as his followers loved to style him,—from whose decision on all disputed points in natural history there was scarcely an admissible appeal. And Linnæus almost merited this distinction, for he was a man not only of superior capacity and acquirements, of great sagacity, ready apprehension, and fruitful fancy, but he was also of a candid and liberal disposition; and the ingenious labours of Ellis received from him great and merited commendation. He had previously, in the belief that lime was never formed but by animals, placed the Lithophyta in the animal kingdom; and he now adopted the opinions of Ellis so far as to include in it the horny and flexible polypidoms also, but at the same time he broached the conjecture, for it deserves no higher praise, that these were really intermediate between the animal and vegetable kingdoms, so that it could not be said they properly belong to either. The animalcules of the Lithophyta, like the testaceous tribes, he said, fabricated their own calcareous polypidom, forming the whole mass into tubes, each ending on the surface in pores or cells, where alone the animal seems to dwell;* but the polypes of the proper Zoophyta, so far from constructing their plant-like polypidoms, were, on the contrary, the productions or efflorescences of it,† just as the flowers do not make the herb or tree, but are the results of the vegetative life proceeding to perfection. Polypes, according to this fancy, bore the same relation to their polypidom that flowers do to the trunk and branches of the tree; both grew by vegetation, but, while the one evolved from the extremities blossoms which shrunk not under external irritations, and were therefore properly flowers,—the other put forth flowers which, because they exhibited every sign of animality, were therefore

* Lithophyta—"animalia mollusca, composita. Corallium calcareum, fixum, quod inædificarunt animalia affixa." Syst. 1270.

† Zoophyta—"animalia composita, efflorescentia. Stirps vegetans, metamorphosi transiens in florens animal." Syst. 1287. "Zoophyta non sunt, uti Lithophyta, auctores suæ testæ; sed testa ipsorum; sunt enim corpora (uti flores) imprimis generationis organa, adjectis nonnullis oris motusque instrumentis, ut motum, quem extrinsecus non habent, a se ipsis obtineant." Syst. Nat. edit. 10. 799.—When Berkenhout translates the first of these definitions—"stems vegetating and changing into animals," (Synop. i. 15,) he certainly departs, if not from the letter, yet from the meaning of Linnæus.

with reason considered animals. "Zoophyta," he writes to Ellis, "are constructed very differently, living by a mere vegetable life, and are increased every year under their bark, like trees, as appears from the annual rings in a section of the trunk of a Gorgonia. They are therefore vegetables, with flowers like small animals, which you have most beautifully delineated. All submarine plants are nourished by pores, not by roots, as we learn from Fuci. As zoophytes are, many of them, covered with a stony coat, the Creator has been pleased that they should receive nourishment by their naked flowers. He has therefore furnished each with a pore, which we call a mouth. All living beings enjoy some motion. The zoophytes mostly live in the perfectly undisturbed abyss of the ocean. They cannot therefore partake of that motion, which trees and herbs receive from the agitation of the air. Hence the Creator has granted them a nervous system, that they may spontaneously move at pleasure. Their lower part becomes hardened and dead, like the solid wood of a tree. The surface, under the bark, is every year furnished with a new living layer, as in the vegetable kingdom. Thus they grow and increase; and may even be truly called vegetables, as having flowers, producing capsules, &c. Yet, as they are endowed with sensation and voluntary motion, they must be called, as they are, animals; for animals differ from plants merely in having a sentient nervous system, with voluntary motion; nor are there any other limits between the two. Those, therefore, who esteem these animalcules to be distinct from their stalk, in my opinion, founded on observation, deceive and are deceived." *

There was something in this hypothesis peculiarly captivating to an imaginative mind, and few poets have possessed a richer fancy than Linnæus. He seems to have ever fondly cherished the opinion, for in his curious Diary, in which he has enumerated, with much complacency, all his works and merits, it is mentioned as one of his principal recommendations to the respect of posterity. "Linné," he says, "decided that they (zoophytes) were between vegetables and animals: vegetables with respect to their stems, and animals with respect to

* Lin. Corresp. vol. i. pp. 151, 152.

their florescence. This idea is still entertained."* Before we notice the manner of its reception by Ellis, we may take a short review of the writings of some other of the opponents of the latter naturalist.

Ellis had indeed effected a revolution in the opinions of scientific men, but there were some even of considerable reputation who either wavered between the old and new, or continued to hold the notions of their fathers,† which, however, very few ventured to maintain publicly. Of these the only one who merits our particular notice is Dr. Job Baster of Zurichsee, in Zealand, who seems to have been very imperfectly qualified for the task he had undertaken. At first he boldly asserted the vegetability of all zoophytes, attempted to prove that the Sertulariæ were really articulated Confervæ, and that the little animals observed on them were merely parasites, which had as little to do with the formation of the object they rested on, as the maggots in a mushroom had to do with its moonlight growth. These the results of his actual observation were set forth in a tone of arrogance calculated to wound the feelings and good fame of Ellis; nor is this conduct to be wondered at, for ignorance is usually as unfeeling as she is proverbially confident in her assertions, and the Dutch naturalist was truly very ignorant of all relating to the subject he attempted to elucidate. Unskilled in marine botany, he actually mistook the objects of the enquiry, and instead of Sertulariæ set himself to examine true Confervæ,—a fact which the drawings illustrative of his paper demonstrate. His further experiments made him fully aware of this ridiculous error; and having become better acquainted with his subject, he appears to have been puzzled what to make of zoophytes; they were certainly not sea-weeds,—and it were too humiliating to adopt a once rejected theory,—when happily the Systema Naturæ came to his aid, and he instantly adopted with

* Pulteney's General View of the Writings of Linnæus, by Dr. Maton, p. 560. Lond. 1805.

† Count Ginanni was one of these, and had the hardihood to question the accuracy of the observations of even Jussieu.—How far he was competent to observe himself, will be made apparent to the zoophytologist by the following extract:—"Loco polyporum Bernardi de Jussieu, papillas septem glandulis consitas reperit, et mucum putat esse, quem vocant cornua: ex papillis vero pressis aqua, deinde lac pullulat, eædemque ad corticem inseparabili nexu adhærent." Hall. Bib. Bot. ii. 444.

zeal the vegeto-animal fancy, because, he says, it illustrated in a wonderful manner other things which were previously obscure and incomprehensible, and because it was in perfect keeping with the doctrine which taught that animated beings were a series of links constituting one long chain, that could not be broken without violation to the continuity of organization,—the different species being so closely connected on this side and that, that neither sense nor imagination can detect the line which separates one from the other. It must be allowed that in Baster the doctrine of Linnæus has found its best advocate. He tells us that in zoophytes there are too many signs of a perfect vegetation to permit us to believe that they can owe their origin to animalcules so minute as to require a microscope to see them, and the great simplicity of whose organization altogether unfits them for perfecting such works; and as, from the law of continuity indicated above, it was reasonable to presume the existence of beings in which the distinctions between animals and plants should meet and amalgamate, so by a comparison of their definitions it may be made obvious that these distinctions disappear in zoophytes. A plant is an organized body without sense or spontaneous motion, adhering by means of a root to some foreign substance, whence it derives the material of its life and increase: an animal, on the contrary, is an organized body endowed with sensation and perception, which can, of its own free will, make certain movements peculiar to itself. Like the plant, zoophytes grow fixed by a root; and yet at the same time they are animals, for they show when touched that they feel by some motion, and when they perceive food proper for them they seize and devour it by the action of certain members.

Having in this manner commended the theory to our favour, and shewn its reasonableness and consonance to nature, Baster goes on to explain the manner in which he conceives his experiments prove that the Sertulariadæ or flexible corallines grow. The ova or seeds of these zoophytes, he asserts, pullulate from the body of the mother in the likeness of tender articulations or new branches, which fall off on maturity, and adhere to any stone, shell, or other hard body, by which they are protected until the young are excluded. Now the outer coat of this egg or seed is of a *vegetable* nature, and it throws

out from the sides, in the manner of other seeds, certain little roots by means of which it remains permanently attached; but the internal part of the egg or seed is *animal*, and growing simultaneously with its vegetable covering, it is dispersed through all the ramifications and occupies their hollow interior, being developed into polypes in the lateral denticles and extreme cells. Such was the deduction he came to from observations made on the growth more especially of the Sertularia abietina, which he had kept alive for nearly four months in a vessel of sea-water. When a new part was formed, there first emerged from the stem a minute tubular joint, which rose to four, five, or even eight lines in height: after some days some lesser buds, regularly disposed in an alternate manner, were seen on the sides of this branch, which in the course of four or six days grew into cells containing perfect polypes. Hence it is obvious to Baster that the stem of this and similar zoophytes grows in thickness and length as plants do, and that the medullary pith is animal, which it is not wonderful should assume a dendroidal form, when we see zinc and quicksilver do the same by the mere force of affinity. Trembley had already pronounced the cells of the fresh-water zoophytes (Plumatella) to be not the work of the polypes, but rather compartments in which they concealed a part of their body; and this fact, added to those already given, makes it certain that the animalcules of the Sertulariadæ are entirely passive, and have no more to do with their polypidoms than the flower has with the increase and growth of the herb.*

There is some ambiguity in Baster's statement of his opinions, for it is not very obvious whether he believed the new-formed branchlets to be themselves the eggs or seeds, or whether they only contained the eggs; but be this as it may, it appears scarcely doubtful that he knew nothing of the true ova and their curious ovaries. The phenomena observed in the production of new parts are correctly stated, but nothing but wilful prejudice could blind him to the fallacy of the consequent reasoning. The analogy attempted to be drawn between the eggs of zoophytes and the seeds of plants has no

* Phil. Trans. vol. lii. pp. 108—118. For Baster's works, see Hall. Bib. Bot. i. 468.

existence, for every tyro knows well that the coat or skin of a seed in no instance ever pushes forth radical fibres, or ever exhibits any sign of vegetation;—it is a dead part, which is cast off or corrupts, and exerts no further influence on vegetation than as a protection to the cotyledons and embryo which it invests, so that, if it is true that the coat of the ova of zoophytes is the source of their vegetative part, as Baster says, that coat must be of a very different nature from the skin of seeds. It would have been better to have compared the oviform bodies of the zoophyte with the buds of the tree, and he might have disported with this fancy to some effect, for there are many analogical resemblances, and the inapplicability of the illustration is not so very plain. Still it is inapplicable, for buds grow from the absorption of water and inorganic matter, which is diffused and assimilated by means of a certain determinate organization, while the covering of zoophytes receives no increase except through the medium of its polypes; —it has no sap-vessels, no spiral tubes, no cellular parenchyma, no absorbent roots, no pores and spiracles on the surface, so that all its material must be derived from an internal source; and to say that a body vegetates when the nutriment is received and assimilated in a different manner, and by a different structure from what it is in plants, and is productive in its assimilation of opposite principles, is to use terms in so vague a sense as would be intolerable in any science.

Neither the authority of Linnæus, nor the imperfect experiments of Baster, had any effect on Ellis, who steadily opposed this vegeto-animal doctrine, and whose superior knowledge made it easy for him to detect and point out the erroneousness of the observations on which it principally rested. In reference to the opinion itself, he wrote to Linnæus,—"Artful people may puzzle the vulgar, and tell us that the more hairy a man is, and the longer his nails grow, he is more of a vegetable than a man who shaves his hair or cuts his nails;* that frogs bud like trees, when they are tadpoles; and caterpillars blossom into butterflies. These are pretty rhapsodies for a Bonnet. Though there are different manners of growth in

* Bohadsch, in answer to those who believed that the Pennatulæ were plants, uses the same argument. De Anim. Mar. p. 123. This author, who wrote in 1761, was a strenuous advocate for the unmixed animality of zoophytes.

the different parts of the same animal, which the world has long been acquainted with, why should we endeavour to confound the ideas of vegetable and animal substances, in the minds of the people that we would willingly instruct in these matters!"* And in a subsequent letter he repeats, "I cannot reconcile myself to vegetating animals: the introduction of the doctrine of this mixed kind of life will only confuse our ideas of nature. We have not proof sufficient to determine it; and I am averse to hypothesis."†

Pallas, who published at this period an admirable history of zoophytes,‡ was also the advocate of the Linnæan doctrine, but he adduced no other facts than those furnished by Baster in its aid,—setting, however, in bolder relief the argument derived from its accordance with the hypothesis of a continuous series in the structure of organized beings, which, it was for long a point of orthodoxy to believe, formed a chain "in linked sweetness long drawn out," graduating insensibly from man to the monad,—as Bonnet maintained; or branching off into lesser series after the manner of a tree,—a simile suggested by Pallas himself as more correctly representing the "System of Nature." § He also adopted the opinion of Baster, who in this respect continued in opposition to Linnæus, that the true corallines (Corallina) were entirely of a vegetable nature, and his arguments on this head may be summed up as follows:—In external appearance and structure a few corallines resemble some Fuci, and many of them are like Confervæ; they differ from other zoophytes in chemical composition, for, on being burned, they emit the smell of vegetable matter, neither do they contain a volatile salt or animal oil; the pores observable in their calcareous portion are too small to be the habitations of polypes, and similar pores can be detected on Fuci; no polypes nor any visible token of life could be discovered by Jussieu in any coralline, a species of which, moreover, a Mr.

* Lin. Corresp. vol. i. p. 226.

† Lin. Corresp. vol. i. p. 260.

‡ "Princeps in hac classe opus." Hall. Bib. Bot. ii. 566.

§ "Didicimus in zoophytis, sic jure vocandis, vegetabilem naturam cum animali ita misceri, ut vere anceps et dubia passim sit," &c. Elenc. Zooph. præf. viii. The Introduction to the work is headed, "De zoophytorum *intermedia natura* et inventione." His ideas of the Natural System are given in an interesting passage at pp. 23, 24, which is too long for quotation in this place.

Meese had found growing upon a heath in Friesland; and, lastly, the fructification of corallines is very similar to that of Fuci and Confervæ.

Were these the deductions of correct observation and experiment, they would unquestionably have been conclusive; but some of them were already known to be contrary to the fact, and the others were weakened with doubts and uncertainties. Ellis, conscious of his superior knowledge both of marine botany and zoophytology, put forth an answer to this attack which is remarkable for clear arrangement, and for candid and honourable bearing to his opponent, who had scarcely deserved this at his hand.* Having shewn that the presumed coralline, which Pallas had compared to a Fucus or sea-weed, was in fact a Fucus, Ellis proceeded to prove how widely different every coralline was in structure and texture from any confervæ; and that the former, contrary to Pallas's assertion, not only gave out when burned "an offensive smell like that of burnt bones or hair," but afforded also on careful analysis both volatile alkali and empyreumatic oil.† "Dr. Pallas," Ellis continues, "proceeds to prove that corallines cannot be animals, as the pores of their calcareous substances are too minute for any polypes to harbour in. These words of the Doctor's seem to imply, as if the coralline substances were only habitations for detached polypes, and not part of the animals themselves. How this affair stands, I hope to have clearly demonstrated long before this, for I have plainly seen, and endeavoured to show mankind, that the softer and harder parts of zoophytes are so closely connected with one another, that they cannot separately exist, and therefore have not hesitated to call them constituent parts of the same body, and

* It appears from the Lin. Corresp. vol. i. p. 186, that Pallas had written disrespectfully of Ellis. In his Elen. Zoophytorum, the latter, however, is profusely complimented:—"Ellisium subtilitate atque acumine observationum omnes super eminentem," (Præf. p. x.) is praise enough surely, but its sincerity might be questionable.

† This character, as Lamouroux remarks, is insufficient, seeing that the major part of marine plants give out, in burning, odours and products analogous to those of animals. Cor. Flex. p. 12. It is now well known that chemistry affords us, in its minute analyses, no test between animal and vegetable matter. See Prout's Bridgewater Treat. p. 415, and more particularly Tiedemann's Comp. Physiology, p. 48, &c.

that the polype-like suckers are so many mouths belonging thereto.

"Now, for the smallness of the pores, which the Doctor has mentioned here (among the corallines) to be a contradiction to animal life; he certainly has forgot one circumstance, when he introduces the Corallium pumilum album, (Essay Cor. t. 27. f. c.) or his Millepora calcarea (Pall. Elench. p. 265,) as an animal, which is, that he there says it has absolutely no pores at all.

"As there can be no doubt, but every part of what is called coralline is necessary to make out such an animal or being, it will be very difficult, if not almost impossible, to determine the proportion there ought to be between softer and harder parts; and therefore it cannot be thought unreasonable to say, that in some of this tribe the stony parts are by much the greater part of the whole, especially as Doctor Pallas's objection can be only against the crust, or lapidescent part, as the inside of many of them is far from being hard, being exactly like a Sertularia, so that I do not know if it would not be a good definition to one well acquainted with that tribe to say, a coralline is a Sertularia, covered with a stony or calcareous crust; if the mouths should happen to be very small, their number may make up that deficiency. We see in the greatest number of corallines their surface full of holes; we saw the same in Escharas and Milleporas thirty years ago: since that time magnifying-glasses have been improved, so as to show us that they are all orifices for polype-like suckers; why should not we now admit that glasses may be still more improved, so as even to make us able to see what may be the intention and use of these minute orifices, which, according to all rules of reasoning, we must suppose to approach in nature to them they are most alike. From this extreme minuteness then of the pores of these Milleporæ, confessed to be zoophytes, as well as those of Corallina officinalis as before mentioned, it is no great matter of surprise, that Doctor Jussieu could not perceive any animal life in the corallines, nor Doctor Schlosser in the Millepora calcarea. As these experiments ought to be attended with many convenient coinciding circumstances, that do not often happen to persons who only go to the sea-side, perhaps for a few days or hours, so that it is unrea-

sonable to conclude, because they have been unsuccessful, that more accurate observers may not be more fortunate at another time."—Having thus disposed of an argument which he could not distinctly answer, Ellis goes on to notice the fact of the coralline which had been found on Bergummer heath in Friesland, and which the vagueness of the manner in which the discovery was announced permitted or warranted him to ascribe to accident; and he then concludes his admirable essay with a faithful and minute account of the fructification of the Confervæ, and proves to a demonstration, that, when Baster and Pallas attributed a similar fructification to corallines, they had very erroneous ideas of the subject.*

The discussion rested here, and zoophytes, including the sponges and corallines, have been ever since enumerated among the subjects of the animal kingdom, although some, among whom Spallanzani may be particularized, continued in the belief that the corallines and the sponges were vegetables. But naturalists continue to be divided in opinion relative to the nature of acknowledged zoophytes, for many, of whom Bory de St. Vincent may be considered the chief,† still speak of them as intermediate beings partaking of a twofold nature; while others, under the leading of Bruguière‡ and Lamarck, defend their claims to pure animality. No new doctrine has been promulgated; neither indeed have the old been defended or attacked by any other facts or arguments than those already referred to, and with these before me I cannot hesitate to give my assent to the opinion of Ellis. No one denies that the polypes, considered abstractedly from their polypidoms,

* Phil. Trans. vol. lvii. p. 404, &c.—Pallas appears to have been convinced by this essay that the corallines were animals; and he acknowledged that in reference to the land species he had been imposed upon. Lin. Corresp. i. 227 and 568. Yet it should be remembered, that Captains Vancouver and Flinders observed on the shores of New Holland, at considerable heights above the level of the sea, arborescent calcareous productions, which they considered to be corals. Peron says they are either corals or vegetables incrusted with calcareous matter; and Dr. Clarke Abel has proved that they are the latter. Edin. Phil. Journ. ii. 198.

† Encyclop. Méthod. ii. 647.—Cuvier, in an early work, gave countenance to this opinion; but in his "Règne Animal," iii. 220, Paris, 1830, it is repudiated.

‡ His definition is carefully worded, that no suspicion of his opinion might be entertained:—"Zoophyta—composita animalia irregulariter coacervata aut ramosa, fere semper basi radicata et *sic plantis analoga.*" Tab. Syst. des Vers, p. vii.

are really animals;—their quick and varied movements,—their great irritability,—the existence of a mouth and stomach,—the nature of their food, its digestion, and the evomition of the indigestible remains, are incontestible proofs of this;—and it seems improbable, to say no more, that this animal should be fitted round with a case that grew independent of it and from a different cause. And the case itself has no analogy, as Ellis shewed very clearly, either to bark or to wood; it possesses the structure of neither of them, nor is it formed in the same manner by the addition of concentric layers, nor does it contribute to the formation of new parts, but, like the shell of testaceous mollusca, it is extravascular, and when once formed suffers no other change than what external injuries or time may operate. If possible, its coincidences with the skin of cellular plants are even fewer: the one is a living part, which has very important functions to perform in relation to the plant itself and to the atmosphere or circumfluent medium in which it lives; the other exhibits no action characteristic of life, and is nothing more than a condensed albuminous or calcareous sheath, appropriated solely to support or protection.*

But, although I agree with the advocates of the animality of zoophytes in general, I cannot go the length of Ellis in considering it proved that sponges and corallines belong to the same class. Ellis, we have seen, knew that no polypes were to be found in sponge, and their existence in the pores of corallines was inferred merely from the structure of these and their chemical composition. They have been examined by subsequent naturalists fully competent to the task, and under the most favourable circumstances,—in particular by Cavolini and Schweigger,—and the result has been a conviction that these productions are truly apolypous. Now this fact, in my opinion, determines the point, for if they are not the produc-

* I do not enter into the question, whether the Confervæ are real animals or not, because, whatever conclusion we might adopt, they would not come within our definition of a zoophyte or polype, since they assuredly have neither mouth, tentacula, nor stomach. Nor need I discuss the propriety of instituting, with Treviranus, a fourth kingdom of animated nature, composed of the zoophytes and aquatic cryptogamia, as my object and plan is only to describe what have been almost universally considered zoophytes.

tions of polypes, the zoologist who retains them in his province must contend that they are individually animals, an opinion to which I cannot assent, seeing that they have no animal structure or individual organs, and exhibit no one function usually supposed to be characteristic of that kingdom. Like vegetables they are permanently fixed,—like vegetables they are non-irritable,—their movements, like those of vegetables, are extrinsical and involuntary,—their nutriment is elaborated in no appropriated digestive sac,—and, like cryptogamous vegetables or algæ, they usually grow and ramify in forms determined by local circumstances, and if they present some peculiarities in the mode of the imbibition of their food and in their secretions, yet even in these they evince a nearer affinity to plants than to any animal whatever.*

* The same reasons induced Dutrochet to come to the same conclusion, (Ann. des Sc. Nat. n. s. x. p. 12;) and the definition of a vegetable given by one of the first botanists on the Continent—"*sensibilitate, voluntate, et motu proprio destituta*"—will certainly include both corallines and sponges. See Macleay's Hor. Entom. p. 197. According to Deshayes, (Traité Elem. de Conchyliologie, i. p. 9,) irritability—"l'irritabilité manifestée par le mouvement"—is the essential characteristic of animals,—a definition which still excludes sponges and corallines from amongst them.

Professor Owen says, "that, if a line could be drawn between the animal and vegetable kingdoms, the sponges should be placed upon the vegetable side of that line. Locomotion could be no proof of animality; for it was well known that the sporules of some cryptogamic plants possessed very perfectly the power of motion."—Lancet, No. 871, p. 225.

THE HISTORY

OF THE

CLASSIFICATIONS OF ZOOPHYTES.

The existence of a polypidom is not essential to a polype; nor does it exercise, when present, that great influence over the organization of its architects and tenants which might have been anticipated. The animal of the madreporous Caryophyllæa does not essentially differ from the naked Actinia; and the gelatinous Hydra is a true representative of the tenant of the sheathed Sertulariadæ and Tubulariæ. No ascidian polype (Polyzoa), however, is ever found detached, and without a polypidom; and it is the same with all our native Astroida.

In reference to their composition, Polypidoms may be divided into 1. the stony or calcareous, 2. the membrano-calcareous, and 3. the horny and flexible; but the line which separates these divisions is often as uncertain and debatable as that which is traced between the sister kingdoms. All are composed of the same materials, viz. lime, and a gelatinous or membranaceous substance; and their peculiar characters depend on the different proportions in which the materials are mixed. The calcareous, which are hard and inflexible, and, when dry, assume a white colour, consist principally of carbonate of lime, with a small quantity of the phosphate of the same earth, and the gelatinous matter which cements them into one coherent mass, is in sparing proportion: that proportion is so greatly increased in the polypidoms of the second section, that when the earthy ingredients have been removed by the action of diluted acids, the structure retains its original form, and is, in fact, reduced to the condition of the polypidoms of the third section, which

F F 2

contain no lime, or very little of it, but are formed of a condensed gelatinous membrane, which resembles horn in every essential property.

These diversities in their chemical composition appear to be of little value, either in a physiological or systematical point of view, for in every order of polypiferous zoophytes, we find calcareous and horny polypidoms. A curious species of Actinia secretes a horny basis, the first rudiment of a madrepore;* but all other madrepores are calcareous; the axis of the Astroida is sometimes of lime, sometimes of horn, and sometimes of membrane: the polypidoms of the Hydroida are flexible and horny without perhaps any exception; but there is no hesitation in asserting, that the ascidian tribes fabricate productions, some of which are referable to every class that the chemist could devise.

The reader who is not already familiar with the outward forms of our native polypidoms, will most easily obtain a correct idea of them, by examining the figures which illustrate this work. The very few and insignificant madrepores, or helianthoid polypidoms, which inhabit the British shores, form either short cylinders or reversed cones, having the apex cupped and starred with lamellæ, which radiate from the depressed centre to the circumference. In the major part of the Astroida, or corticiferous polypidoms, there is a central calcareous or horny axis, which may be compared to the wood of a tree, and which is formed by the successive deposition of layer over layer: this is coated or barked round with a living irritable flesh or jelly, thickened with calcareous matter, which has usually crystallized in the form of spicula. The cells of the polypes are excavated in this soft bark, on the surface of which they open by an aperture, which is always cut into eight rays disposed in a starred fashion, and corresponding to the number of the polype's tentacula; and this aperture can be opened and shut at the pleasure of the inmates. In Alcyonium, although an asteroid, there is no

* It has been doubted whether this horny base is formed by the Actinia, but I quite agree with Dr. Coldstream, that "it is secreted by its base, and that it is as much part of the animal, in fact its skeleton, as are the calcareous axes of Caryophyllæa, Fungia, &c., between which and the true Actinia, it seems to form a well-marked link."—See the Edin. New Phil. Journ. ix. p. 238.

solid axis, but there is an evident tendency to its formation; the materials lying scattered in the form of spicula in the soft gelatinous centre.

The polypidoms of the Hydraform and Polyzoan zoophytes are more diversified in their figures and more decidedly arborescent. The latter are formed by an aggregation of distinct cells, united in general after the fashion of the quincunx, and spread out into leaves or layers or compressed branches; or the cells being placed upon each other in pairs, or even in a single line, they form neat confervoid tufts; or lying immersed without any very traceable pattern, the masses resulting from their union are amorphous, or at least inconstant and irregular. The horny material of the Hydra tribe is always formed into tubular sheaths encasing the living flesh, jointed at intervals, sometimes of the same calibre throughout, but more commonly dilated at intervals into vases or cups, or cells, in which the proper body of the polype is placed. The manner in which the sheath or tube is divided and branched, is limited in diversity only by the number of the species, which are among the most delicate and interesting of all polypidoms, and pre-eminently imitative of vegetable forms. These forms are of course altogether independent of their animated tenants,—these "have been specicfially appointed by Him to do what they have done, and are still effectuating. They are mere instrumentalities at His command. They know nothing of the results they cause, nor mean to perform any of them, nor could of themselves co-operate with each other, nor produce any systematical arrangement, or regulated or orderly effects. It is their Master and Maker who organizes, governs, and guides them to those movements and operations which they perform, and from all others; so that by His directing will they are made to do what we see them effect, and that only because He restrains and averts them from all else."*

The formation of polypidoms has been the subject of considerable discussion. The opinion of Ellis, as we have already seen, was, that they are the result solely of a transudation, or excretion of the constituent matters from the body of

* Turner's Sac. Hist. of the World, Vol. ii. p. 71.

the polypes, and this opinion has been maintained recently by Lamarck, and some other naturalists. It rests on the assumption that the polypidom is extravascular and inorganic, so that after its first solidification, it suffers no alteration in form and quality, beyond what is evidently effected by the operation of chemical and mechanical causes: the changes resulting from its increase in size, are not from the activity and pulsion of any inherent principle, but from the superimposition of additional layers, or from the additions of new cells, or from the prolongation of the tubes, which additions are all coetaneous with the growth and multiplication of the polypes, and the results of new secretions. Linnæus, Pallas and Baster opposed Ellis, and believed in a vegetative principle, inherent in the polypidom itself, so that its growth was in some measure independent of the living tenant; and various arguments have been brought forward by Bory de St. Vincent,* which appear to him to demonstrate the truth of this doctrine. We may act, however, not unreasonably in withholding our assent, for with such a feeble and errant point was the argument handled that few felt its force, and the discussion has continued even to this day in an unsettled state.† It seems probable, in fact, that neither theory will explain the growth of all polypidoms; and as the peculiarities which distinguish these are considerable, and would render a general description involved and obscure, I have given the explanation of their mode of increase in the preface to each separate order. Enough has in the meantime been said to show how unimportant the polypidom must be as a *primary* character in a natural classification of zoophytes, and yet, until very recently, no other basis was looked for or deemed available, and hence the artificialness of the proposed "Systems" which, as a matter of history, we now venture to review.

The main object of Ellis being to prove the animality of zoophytes, he deemed a new classification of them unneces-

* Encyclop. Method. art. Zoophyte.

† Milne Edwards and Mr. Couch have, perhaps, demonstrated that the polypidom is an integral part of the animal, and subject to change from intus-susception. Besides the references already given, see Ann. Nat. Hist. iii. p. 214.

sary, and, as it was sufficient for his purpose, he followed very closely that which had been proposed by Ray in his Synopsis of British Plants.* In successive chapters he treats of the vesiculated corallines (Sertulariadæ), the tubular corallines (Tubulariæ), of the celliferous (Cellariadæ), and of the articulated corallines (Corallina), of Keratophyta, of the Eschara, of the English corals, of sponges, of the Alcyonium, and of tubular corals, under which head he describes several of the more common tubicolous worms which are found on our coast, and which have no relationship whatever to the other subjects of his treatise. Looking back on this arrangement from our present vantage ground, it appears disorderly and very defective; but when we reflect how imperfect the knowledge of species was at that period, and how crude the notions were on the nature and use of systems, we may find much to commend in it. Some of the chapters indeed contain a mixture of very dissimilar things, but others may be justly considered as so many natural genera or families, which subsequent naturalists had merely to subdivide and name.

Linnæus—in every sense the first of systematists—published the tenth edition of his Systema Naturæ in 1758. In it the avertebrate animals are arranged in two classes, Insecta and Vermes,—and of the latter zoophytes, with the exception of Actinia, which is placed amongst the mollusca, form the last two orders, which he named Lithophyta and Zoophyta. That we may appreciate the nature and value of the changes proposed subsequently to his time, it will be necessary to give the definitions of his orders and genera.

I. "LITHOPHYTA Mollusca composita, basin solidam ædificantia.
TUBIPORA *Corallium* tubis cylindricis.
MILLEPORA *Corallium* tubis obconicis teretibus.
MADREPORA *Corallium* tubis stellatis."

II. "ZOOPHYTA Plantæ vegetantes floribus animatis.
ISIS *Stirps* radicata, lapidea, nuda, geniculis corneis.
GORGONIA *Stirps* radicata, cornea, crustata, continua.
ALCYONIUM *Stirps* stuposa, corticata, continua.
TUBULARIA *Stirps* fistulosa, tunicata, subgeniculata.

* Syn. Meth. Stirpium Brit. Edit. 3. Lond. 1724.

ESCHARA *Stirps* papyracea, nuda, porosa.
CORALLINA *Stirps* fibrosa, crustata, articulata: articulis multifloris.
SERTULARIA *Stirps* fibrosa, nuda, articulata: articulis unifloris.
HYDRA *Stirps* subradicata, gelatinosa, apice florifera.
PENNATULA *Stirps* libera, pennata, basi ore instructa.
TÆNIA *Stirps* libera, moniliformis, articulata.
VOLVOX *Stirps* libera, globosa, sobole nidulante."*

The precision of the definitions in this arrangement, and the manner in which they are contrasted, is highly characteristic of its author, but into many of the genera species are introduced, which are not conformable to the definitions; and some of these, Pennatula and Hydra, for example, are grossly erroneous. The theoretical character of the second order, and of some of its genera, might also be objected to in a matter-of-fact work; but it is an easy task for the student of the present æra to point out defects in the method of the master who had to plan the way, and who succeeded in making it level and easy to his followers.

Pallas, in 1766, embraced the Lithophyta and Zoophyta in one order, for which he adopted the latter denomination, for he very properly believed that the Linnæan distinctions served only to "divide the things that are in nature join'd." He separated some spurious species of Hydra and formed them into the genus *Brachionus*, which, though a good genus, is a doubtful member of the order of zoophytes. His genus *Antipathes*, severed from Gorgonia, is well defined; and with equal propriety he restored the celliferous corallines of Ellis, which Linnæus had mixed with the Sertularia, to a separate generic rank—*Cellularia*. The claims of Tænia, Volvox, and Corallina to a place amongst zoophytes were disallowed, although he has described the species in an appendix, for he knew that Tænia properly belonged to the intestinal worms, and Volvox to the infusorial animalcules; and he believed that Corallina was altogether of a vegetable nature.

In the twelfth edition of the "Systema," published in 1767, Linnæus made no material improvements on his first system, but the errors relative to the Hydra and Pennatula

* Syst. Nat. p. 646. Halæ Magdeburg. 1760.

are corrected, and the definitions in general are abridged and rendered less theoretical. To the Lithophyta he added the genus *Cellepora*—"corallium cellulis cavis;"—and he followed Ellis and Pallas in now introducing the Sponges into his second order. In this we also find, for the first time, the genus *Vorticella*, which is nearly synonymous with the *Brachionus* of Pallas; the *Flustra*, which is the same as Eschara of his preceding edition; the *Furia*, which is an apocryphal animal; and the *Chaos*, which is an infusory animalcule. Were we to analyze the genera we should find, in almost every one of them, species which properly belong to a different class of animals, or whose characters are at variance with those assigned to the genus: but many of these misplacements were the almost necessary consequences of the then state of knowledge relative to the beings in question.

Solander, in arranging the materials of Ellis, followed the system of Pallas, but he introduced and placed the Actiniæ at the head of the order; he entirely rejected all the intestinal worms and infusory animalcules; and he amended the definitions of the genera by carefully avoiding all theoretical phraseology. He used the term "Zoophyta" exactly in the same sense, and with the same latitude, that it is used in the present work.*

The method of Müller cannot be considered as any improvement on those of his predecessors, but there is an attempt after novelty in it. He places the Actinia and the Hydra among the Mollusca, an order full of heterogeneous things, embracing the cuttle-fish, snails, and star-fish; and in the same order we find the beautiful Lucernaria, one of the discoveries of this industrious and excellent naturalist. The proper zoophytes he denominates Cellularia, which are defined to be compound animals, enclosed in cells, and propagating by means of buds. The genera are classed and defined as follows:

* The natural history of many curious and uncommon Zoophytes, by the late John Ellis, systematically arranged and described by the late Daniel Solander. Lond. 1786. 4to.

* *Calcarea.*

Articulata, tenera, . . .	CORALLINA.
Articulata, lapidea, . . .	ISIS.
Tubulosa, aggregata vel solitaria, .	TUBIPORA.
Foraminulosa, . . .	CELLEPORA.
Lamelloso-stellata, . . .	MADREPORA.
Pertusa poris, . . .	MILLEPORA.

** *Subcornea.*

Tubulosa, *tentaculis* simplicibus, . .	FISTULARIA.
Tubulosa, *tentaculis* cristatis, . .	TUBULARIA.
Ramosa, nuda, *tentaculis* manifestis, .	SERTULARIA.
Ramosa, incrustata, *tent.* inconspicuis .	GORGONIA.

*** *Fungosa.*

Ossiculum polypiferum, . .	PENNATULA.
Suberosa, polypis stellatis, . .	ALCYONIUM.
Stuposa, osculis hiantibus, . .	SPONGIA.
Osculis atomiferis, . . .	CLAVARIA.*

The last genus is a sort of mushroom which Müller was led to arrange among zoophytes from having witnessed the apparent spontaneous movements of its sporules; but no one has followed him in this, although, it may be remarked, that some recent authors have no better reasons for their proposal to remove a large proportion of the aquatic algæ to the animal kingdom.†

* Zooloogiæ Danicæ Prodromus, p. xxxi. Havn. 1776. The authority of Linnæus probably led Müller to his classification of the Fungi. In writing to Dr. Pulteney, February the 18th, 1767, Professor Martyn says,—"I doubt you will conceive that Linnæus is gone mad, if I tell you his opinion concerning *Funguses.* In a letter to Mr. Collinson, he thus expresses himself about them :—'Quis potuerat a priori dicere, Fungos esse *Animalia*, et eorum ova excludi in aquis, et more piscium ludere, dein transire in Fungos? Mihi semper occurrit istud Plinii,—'mihi contuenti sese persuasit rerum natura, nil incredibile existimare de ea.' Delectatus fui hoc autumno videre istos vermes e quibus Fungi prodeunt, et eorum stupendam metamorphosin ex agilissimis vermibus in immobiles herbaceos Fungos.' I shall soon begin to be in pain, lest our poor kingdom of *vegetables* should be crushed into atoms, by the animals on the one hand, and the fossils on the other! What Linnæus means, I do not at present understand ; but the very dreams of so great a genius merit our attention."—Gorham's Memoirs of John Martyn, &c. p. 134.

† In his Systema Naturæ (1767) Linnæus informs us that the Chaos fungorum, which is in fact the seed of the Lycoperdon, Agarics, Boleti, Moulds, and of Fungi in

Blumenbach adopted the Linnæan class Vermes, and he also retained the Actiniæ in the order Mollusca, but the proper zoophytes were differently arranged, and the alteration was unquestionably for the worse. The " polypes and other zoophytes inhabiting coral branches and similar structures" formed the order *Corallia;* and his *Zoophyta* included only the " naked plant-like animals without any habitations ; also the animalculæ of infusions ! " The genera were the same, or nearly the same, as the Linnæan, and followed one another apparently as their names had risen in random series to his memory.*

About the beginning of the present century, Cuvier, first of all, pointed out the advantages of having our systematical arrangements in harmony with anatomical structure,—of making the one an index to the other,—of classifying animals not according to one or two external characters which might really have little or no influence upon their anatomy and habits, but according to their agreement in those great systems by which the life, growth, and propagation of creatures are upheld and carried on. When, however, he began to arrange the animal kingdom accordingly, the knowledge of the organization of Zoophytes was too imperfect to permit him to follow out his principles in this department, and even his latest systematical attempt exhibits many derelictions of them. Having, at the suggestion of Pallas, established a section of avertebrated animals for the reception of such as exhibited in the disposition of their organs a radiated appearance, to the whole of which he applied the term Zoophytes, he subdivided it into five classes, of which the last but one embraced the subjects of the present treatise. They were named Polypes because, from the tentacula encircling their

general, on being dispersed from its matrix, lives and dwells in the water, where it becomes at length fixed, and grows up into Fungi. This fact he gives on the authority of Munchhausen ; and hence he infers that as the metamorphosis of zoophytes is from the vegetable to the animal, so, on the contrary, that of the Fungi is from the animal to the vegetable. The Chaos ustilago, or smut, is also classed by Linnæus amongst zoophytes ; for Munchhausen had proved that if the seminal powder were macerated in tepid water for some days, it would pass into oblong hyaline animalcules which sported about like fishes, as might be seen with the microscope.—Syst. Nat. p. 1326.

* Elements of Natural History, p. 269 and 274. Lond. 1825.

mouth they somewhat resembled the cuttle-fish called Polypus by the ancients; and they were defined to be little gelatinous animals, the mouth of which, encircled with the tentacula, lead into a stomach sometimes simple and sometimes furnished with intestines in the form of vessels. It is in this class that we find those innumerable compound animals, with a fixed and solid stem, which were so long regarded as marine plants. The following is a synopsis of Cuvier's method, as it appears in the last edition of the "Règne Animal."*

Les Polypes.

Ord. I. P. charnus.
- Les Actinies. (Actinia, *Lin.*)
  - Actinia.
  - Zoanthus. *Cuv.* (*nov. gen.*)
- Les Lucernaires.
  - Lucernaria.

Ord. II. P. gelatineux.
- Hydra.
- Corine.
- Cristatella. *Cuv.* (*nov. gen.*)
- Vorticella.
- Pedicellaria.

Ord. III. P. a polypiers.
- *Fam.* i. Les Polypes à tuyaux.
  - Tubipora.
  - Tubularia.
  - Sertularia.
- *Fam.* ii. Polypes à cellules.
  - Cellularia.
  - Flustra.
  - Cellepora.
  - Tubulipora.
  - Corallina.
- *Fam.* iii. Les Polypes corticaux.
  - *Tribe* 1. Des Ceratophytes.
    - Antipathes.
    - Gorgonia.

* Paris, 1830, vol. iii. p. 289 et seq.

Tribe 2. Les Lithophytes.
Isis.
Madrepora.
Millepora.
Tribe 3. Polypes Nageurs.
Pennatula. Subgenera—Pennatula, *Cuv.* Virgularia, *Lam.* Scirpearia, *Cuv.* Pavonaria, *Cuv.* Renilla, *Lam.* Veretillum, *Cuv.* Ombellularia, *Cuv.*
Tribe 4. Alcyons.
Alcyonium.
Spongia.

In the definitions there is throughout a certain degree of vagueness, or at least the absence of that finicalness, which is so pleasing to the practical systematist ; and in the value of the characters chosen to separate the orders and families there is great inequality. Hydra and Corine, for example, are more nearly allied to Tubularia and Sertularia, than the latter are to the Ceratophytes, yet these are placed in one and the same, and the Hydra in a separate order. Had the Ceratophytes been elevated to the rank of an order, and the Madrepora been removed to the *Polypes charnus*, the system would have been improved, and no very obvious alliances broken. In the subordinate parts of the system there are many misplacements of the subgenera, as the genera of his contemporaries were named, of which we may instance the Campanularia which is placed under Tubularia of Linnæus, to which, however, it has certainly much less affinity than to the Sertularia, where it had always hitherto been assigned.

In 1810, Lamouroux of Caen presented to the Academy of Sciences of Paris a new classification of the flexible polypidoms; and it would appear that Lamarck was engaged at the same time in similar labours; but, proceeding on different principles, they arrived at very different results. The anatomy of the workers or polypes was, according to Lamouroux, so imperfectly ascertained, and from their situation as well as from their minuteness, so little within attainment, that it seemed hopeless to procure materials for a classification from that source, and he confined his attention solely to the polypidoms, on whose *composition* he founded his primary

divisions. Lamarck, although he also confined his examination to the polypidoms, took higher ground: he maintained that as these were secreted by the polypes and formed on and by them, a sameness in the structure of the one necessarily implied a sameness in the structure of the other; that in fact we might as safely infer a sameness of structure or dissimilarity from the various configurations of the polype-cells and coral, as we could from an actual inspection of the animated tenants themselves. The experience of a few years has shown either that Lamarck's examination of the coral was hasty, or that his principle was erroneous, for his arrangement is far from being in harmony with a physiological one, and, although greatly superior to Lamouroux's, yet is not the less artificial; there being even in some of his genera, species whose polypes are widely at variance with each other. I do not mean to trace the systems of either of these authors through their various changes, from their first promulgation to their perfection;* an outline of them in their latest state is sufficient for our purpose.

System of Lamouroux.† (1821.)

Division I.

POLYPIDOMS FLEXIBLE, OR NOT ENTIRELY STONY.

Section 1.

Polypiers Celluliferes.—Polypes in non-irritable cellules.

Ord. I. Celleporées.—Tubulipore. Cellépore.

Ord. II. Flustrées.—Berenice. Phéruse. Elzerine. Flustre. Electre.

Ord. III. Cellariées.—Cellarie. Cabérée. Canda. Acamarchis. Crisiè. Menipée. Loricaire. Eucratée. Alecto. Lafæe. Hippothoé. Aétée.

Ord. IV. Sertulariées.—Pasythée. Amathie. Nemertesie. Aglaophenie. Dynamēne. Sertulaire. Idie. Entalaphore. Clytie. Laomédée. Thoée. Salacie. Cymodocée. Amphitöite.

* Blainville has given a history of *all* the proposed classifications in chronological series in his Manuel d'Actinologie, which the reader may consult with advantage.

† The primary sections of this systematist may have been borrowed from J. E. Roques de Maumont.—See Blainv. Man. d'Actinol. p. 23.

Ord. V. Tubulariées.—Tibiane. Näis. Tubulaire. Cornulaire. Telesto. Liagore. Neomeris.

Section II.

Polypiers Calciferes.—A calcareous substance mixed with the animal matter or covering it, apparent in all its states.

Ord. VI. Acetabulariées.—Acetabulaire. Polyphyse.

Ord. VII. Corallinées.—Galaxaure. Nesée. Janie. Coralline. Cymopolie. Amphiroé. Halimede. Udotée.

Section III.

Polypiers Corticiferes.—Composed of two substances, an exterior and enveloping, named the bark or crust; the other, called the axis, placed in the centre and sustaining the first.

Ord. VIII. Spongiées.—Ephydatie. Eponge.

Ord. IX. Gorgoniées. — Anadyomène. Antipathe. Gorgone. Plexaure. Eunicée. Municée. Primnoe. Corail.

Ord. X. Isidées.—Mélitée. Mopsée. Isis.

Division II.

POLYPIDOMS ENTIRELY STONY AND INFLEXIBLE.

Section I.

Polypiers foramines.—Cells small, perforated, almost tubular, without internal plates.

Ord. XI. Escharées.—Adeone. Eschare. Rétépore. Discopore. Diastopore. Obalie. Celleporaire.

Ord. XII. Milléporées.—Ovulite. Reteporite. Lunulite. Orbulite. Ocellaire. Melobésie. Eudée. Alveolite. Distichopore. Homere. Krusensterne. Tilesie. Théonée. Chrysaore. Millepore. Terebellaire. Spiropore. Idmonée.

Section II.

Polypiers lamelliferes.—Stony, the cells in the form of lamellated stars, or waved furrows garnished with lamellæ.

Ord. XIII. Caryophyllaires.—Caryophillie. Turbinolopse. Turbinolie. Cyclolite. Fongie.

Ord. XIV. Meandrinées.—Pavone. Apsendesie. Agarice. Meandrine. Monticulaire.

Ord. XV. Astrées.—Echinopore. Explanaire. Astrée.

Ord. XVI. Madréporées.—Porite. Seriatopore. Pocillopore. Madrepore. Oculine. Styline. Sarcinule.

Section III.

Polypiers tubulés.—Stony, formed of distinct and parallel tubes.

Ord. XVII. Tubiporées.—Catenipore. Favosite. Eunomie. Tubipore.

Division III.

POLYPIDOMS CARNOSE, MORE OR LESS IRRITABLE AND WITHOUT A CENTRAL AXIS.

Ord. XVIII.—Alcyonées. Alcyon. Lobulaire. Ammothée. Xenia. Anthelie. Alcyonidée. Alcyonelle. Hallirhoe.

Ord. XIX. Polyclinées.—Distome. Sigilline. Synoique. Aplide. Polycline. Didemne. Eucelie. Botrylle.

Ord. XX. Actinaires.—Chenendopore. Hypalime. Lymnorée. Pelagie. Montlivaltie. Isaure. Iérée.

Remark on this system seems almost unnecessary. The student will deem it too complex with all its sections and subsections; and the experienced naturalist will at once eschew it as only tending to embroil and confuse and nullify all the knowledge which has been acquired on the structure and physiology of the remarkable creatures which are here so elaborately misarranged. Animals which the admirable anatomical researches of Savigny had proved, by the consent of all, to belong to a different category, are here forcibly degraded to their Linnæan rank, and stand in juxtaposition with true zoophytes on the one hand, and doubtful ones on the other; and, perhaps to make room for these pretenders, some rightful claimants, as Hydra and Pennatula, are altogether excluded: some genera so nearly allied that their distinction may be questioned, for example, Flustra and Eschara, stand in different divisions at wide distances; while others, which have not one character of importance to connect, and every thing to dissever them, are placed almost in juxtaposition, as the Sponges and the Gorgoniæ. The merits of Lamouroux have always appeared to me to have been much overrated: it is a very easy matter, by arbitrarily fixing on this or that character, to set in order any given number of objects in any pattern we may choose; and Lamouroux had no higher notion of the character of a systematist than this, and acted accordingly. It is very true that he named and distinguished many

genera, but who, on critically examining these genera, will deny that he proceeded without caution and without judgment,—determined apparently to make as many as could be made, that his successors might be spared the unprofitable task of coining and inventing names ! *

System of Lamarck. (1816.)

Class POLYPI.

Order I. P. ciliati.

Polypes without tentacula, but having near the mouth, or at its orifice, vibratile ciliæ or ciliated and rotatory organs which agitate or whirl the water.

I *Section.*—Vibratiles.—Rattulus, Trichocerca, Vaginicola.

II *Section.* — Rotiferes. — Folliculina, Brachionus, Furcularia, Urceolaria, Vorticella, Tubicolaria.

Order II. P. denudati.

Polypes with tentacula, without an envelope or polypidom, and fixed, either permanently or spontaneously.

Hydra—Coryne—Pedicellaria—Zoantha.

Order III. P. vaginati.

Polypes with tentacula, invariably fixed in an inorganic polypidom which envelops them; and forming, in general, compound animals.

* *Polypidoms of homogeneous composition.*

I *Section.* Polypiers fluviatiles.—Difflugia, Cristatella, Spongilla, Alcyonella.

II *Section.* Polypiers vaginiformes. * Polypidoms naked, not varnished nor encrusted on the exterior. (1) Cells terminal —Plumatella, Tubularia, Cornularia, Campanularia. (2) Cells lateral—Sertularia, Antennularia, Plumularia, Serialaria.—* * Polypidoms varnished or slightly crusted on the exterior. Liriozoa, Cellaria, Anguinaria, Dichotomaria, Tibiana, Acetabulum, Polyphysa.

* Blainville in criticising Lamouroux's latest work, says, " Nous nous bornerons à dire que Lamouroux a encore considerablement augmenté le nombre des genres, surtout parmi les polypiers pierreux, pour y placer un grand nombre de corps organisés fossiles, trouvés dans le calcaire à polypiers de Caen, et que malheureusement la plupart de ces genres sont mal caractérisés, ce dont je me suis assuré directement sur les objets mêmes qui ont servi à ses observations."—Man. d' Actinol. p. 54.

III *Section.* POLYPIERS A RESEAU.—Flustra, Tubulipora, Discopora, Cellepora, Eschara, Adeona, Retepora, Alveolites, Ocellaria, Dactylopora.

IV *Section.* POLYPIERS FORAMINES.—Ovulites, Lunulites, Orbulites, Distichopora, Millepora, Favosites, Catenipora, Tubipora.

V *Section.* POLYPIERS LAMELLIFERES.—* Stars terminal—Stylina, Sarcinula, Caryophyllia, Turbinolia, Cyclolites, Fungia. ** Stars lateral or spread over the surface—Pavonia, Agaricia, Meandrina, Monticularia, Echinoporia, Explanaria, Astrea, Porites, Pocillopora, Madrepora, Seriatopora, Oculina.

VI *Section.* POLYPIERS CORTICIFERES.—Corallium, Melitæa, Isis, Antipathes, Gorgonia, Corallina.

VII *Section.* POLYPIERS EMPATES. — Penicillus, Flabellaria, Spongia, Tethia, Geodia, Alcyonium.

Order IV. P. TUBIFERI.

Polypes united on a common fleshy living body, either simple or lobed, or branched, and attached by its base: no external polypidom; no solid internal axis; the surface loaded with numerous tubiform little cylinders, rarely entirely retractile. Mouth terminal; tentacula 8, pectinated; no anus; 8 longitudinal semi-partitions underneath the stomach; 8 intestines of two kinds; 6 groups of gemmæ resembling as many ovaries.

Anthelia, Xenia, Ammothea, Lobularia.

Order V. P. NATANTES.

Polypes united on a common free elongated fleshy and organic body, enveloping a cartilaginous almost bony and sometimes stony inorganic axis. Tentacula set in a radiating manner round the mouth of each polype.

Veretillum, Funiculina, Pennatula, Renilla, Virgularia, Encrinus, Umbellularia.

In the outline this system is not very materially different from that of Cuvier, the deviations being sometimes for the better and sometimes for the worse. If the *Polypi ciliati* are to be numbered amongst proper zoophytes, it is for the better to have them placed in a separate order; but Zoantha is badly associated with the Hydra, Coryne, and the spurious Pedicellaria. The *Polypi vaginati*, considered as an order,

is a most heterogeneous collection; and the manner of its subdivision into sections, although in general excellent and worthy of commendation, is yet far from unexceptionable; and these exceptions are very obvious in the first, sixth, and seventh sections, in which apolypous, or it may be vegetable productions, are mingled with real zoophytes. The characters which divide the *Polypi tubiferi* from the *natantes* are not of sufficient importance to be considered ordinal (it would have been preferable to have made them families in one order); and the location of the Encrinus in the latter is the result of a most unlucky conjecture.* As a systematist, however, Lamarck has few equals, and probably, with the exception of Linnæus, not a superior:† there is no vagueness nor ambiguity about him,—all is clear, well arranged and ordered, and his characters, which are usually well chosen, are defined in expressive words and in a felicitous manner. These advantages have given his System great currency, and though the favour shewn to it has somewhat abated, it still holds its place, and is in frequent use, with those who are engaged in arranging local catalogues and museums.‡

* According to Lamarck, Nature could not have done otherwise than she has done, and we are repeatedly assured that his System is a naked exposition of her necessitated steps in calling organized beings into existence! After announcing with an almost ludicrous degree of confidence and complacency, that this fictitious Power can only complicate animal organizations in successive gradation, he adds,—"La connaissance de cette vérité me suffit; je reconnais le véritable rang des *polypes*, comme celui des infusoires; j'aperçois les rapports qui les lient les uns aux autres, ainsi que ceux qui lient les familles entr'elles; enfin, je conçois les limites que la nature n'a pu franchir dans la composition de l'organization de ces animaux, d'après celles que je découvre dans ceux des classes supérieures. Je puis donc dire positivement, à l'égard des *polypes*, comme à celui de bien d'autres, ce que la nature n'a pas pu faire." Anim. s. Vert. ii. 8.—What a humiliating commentary and lesson have the discoveries of a few short years afforded on this passage!

† I have pleasure in referring the reader to Mr. Macleay's high estimate of this naturalist in his Hor. Ent. pt. ii. p. 328-9.—"Lamarck, auquel M. Bory de Saint-Vincent, non moins que nous son admirateur, donna le premier avec raison le titre de *Linné français.*."—Deshayes, Traité Elem. de Conchyliologie, i. p. 27.

‡ An outline of the classification of Dr. August Friedrich Schweigger, from his "Handbuch der Naturgeschichte," &c. Leipzig, 1820.

Classis.—ZOOPHYTA.

Divisio A.—Zoophyta monohyla.

Corpus ex unica substantia constructum.

Ordo.—Monohyla brachiata.

Fam. 1.—*Monohyla hydriformia*=Polypi denudati, Lam.

Fam. 2.

Dr. Fleming is the only British naturalist who has attempted an original classification of Zoophytes, and although no one, from his previous studies and important discoveries relative to their structure and functions, ever came better prepared for the task, yet the system he framed is assuredly not superior to those of his predecessors. The Actiniæ and Lucernaria were collocated with the *Radiata acalepha* or sea-jellies, and the Zoophyta divided into four orders as follow:*

I. Carnosa.

Polypi connected with a fleshy substance.

Keeping this definition in view, who would have expected to find Sponges and Corallines and Madrepores under this order? and yet they are there in defiance of the definition. The following is a synopsis of this order—

I. *Free; marine; moving by the contraction or expansion of the*

Fam. 2.—*Monohyla petalopoda*=Polypi tubiferi, Lam. excl. gen. Lobularia.

Obs.—The Infusoria are also all arranged under this division.

Divisio B.—Zoophyta heterohyla.

Zoophyta e diversis substantiis juxtapositis formata.

Ordo.—Corallia=Polypi vaginati, Lam.

Subordo.—Lithophyta.

Fam. 1.—*Lithophyta nullipora*=Milleporæ, Lam.

Fam. 2.—*Lithophyta porosa.* Gen.: Distichopora, Seriatopora, Madrepora, Millepora, Stylophora.

Fam. 3.—*Lithophyta lamellosa.* Gen: Cyclolites, Fungia, Pavonia, Agaricia, Echinopora, Lithodendron, Turbinolia, Anthophyllum, Strombodes, Acervularia, Explanaria, Astrea, Sarcinula, Meandrina, Monticularia, Stylina.

Fam. 4.—*Lithophyta fistulosa.* Genera: Catenipora, Tubipora, Favosites.

Subordo.—Ceratophyta.

Fam. 5.—*Ceratophyta spongiosa.* Genera: Spongilla, Achilleum, Manon, Tragos, Scyphia, Tethya, Geodia.

Fam. 6.—*Ceratophyta alcyonea.* Genera: Cristatella, Alcyonella, Lobularia.

Fam. 7.—*Ceratophyta tubulosa.* Genera: Plumatella, Tubularia, Neomeris, Tibiana, Anguinaria, Cornularia, Campanularia, Pasythea, Serialaria, Halecium, Sertularia, Antennularia, Electra, Salicornaria, Cellularia.

Fam. 8.—*Ceratophyta foliacea.* Genera: Tubulipora, Cabarea, Canda, Elzerina, Pherusa, Flustra, Cellepora, Alveolites, Ocellaria, Eschara, Retepora, Adeona, Lunulites, Orbulites.

Fam. 9.—*Ceratophyta corticosa.* Genera: Antipathes, Anadyomena, Gorgonia, Isis, Melitæa, Corallium.

Fam. 10.—*Pennæ marinæ.* Genera: Umbellaria, Pennatula, Virgularia, Scirparia, Pavonaria, Renila, Veretillum.

* History of British Animals, Edin. 1828. 8vo.

fleshy part; form symmetrical; axis of the body supported by a bone contained in a sac.

Pennatula.

Virgularia.

II. *Fixed or stationary.*

A. Polypiferous matter covering a solid axis.

a. Axis with stellular discs.—LAMELLIFERÆ.

b. Stellular discs terminal.

Sarcinula.

Lithostrotion.

Caryophyllea.

Turbinolia.

Cyclotites.

b b. Stellular discs aggregated.

Explanaria.

Astrea.

Porites.

Pocillopora.

a a. Axis destitute of cellular discs.

b. Axis corneous and flexible; polypiferous basis cretaceous; the axis with spines.

c. Polypi developed.—GORGONIADÆ.

Gorgonia.

Primnoa.

c c. Polypi not developed.—CORALLINADÆ.

Jania.

Corallina.

Halimeda.

b b. Axis stony.

Isis.

B. Polypiferous basis destitute of a continuous solid axis.

a. Polypi developed.

b. Polypi with 8 tentacula; the base fibrous.

Lobularia.

Cydonium.

Cliona.

b b. Polypi with tentacula exceeding 8 in number; basis nearly uniform.

Alcyonium.

Cristatella.

a a. Polypi not developed.—SPONGIADÆ.

Tethya.
Halichondria.
Spongia.
Grantia.

II. Cellulifera.

Polypi lodged in calcareous cells imperforate at the base.

A. *Substance rigid, stony.*

I. Cells in the form of minute pores, imbedded.—Milleporadæ.

Millepora.

II. Cells tubular, and produced beyond the surface.—Tubiporadæ.

Tubipora.
Favosites.
Tubulipora.
Discopora.
Filipora.
Terebellaria.

III. Cells utriculur, adjacent, or superimposed. — Escharadæ.

Eschara.
Retepora.
Cellepora.
Berenicea.
Hippothoa.
Alecto.

A A. *Substance flexible.*—Flustradæ.

Farcimia.
Flustra.

III. Thecata.

Polypi surrounded by a membranaceous tube, covering the subdivisions of their compound body.

A. *Sheath slightly calcareous; cells single, or in rows.*

I. Sheath slightly calcareous, cells enlarged, in rows, united or single.—Cellariadæ.

a. Cells united.

b. Cells with the orifices opening on the upper surface.

Cellularia.
Tricellaria.
Crisia.

b b. Cells in pairs, attached by the back, the orifices with opposite aspects.

Notamia.

a a. Cells single.

Eucratia.

Anguinaria.

A A. *Sheath membranaceous, cells enlarged externally and lateral.*—Sertulariadæ.

I. Base of the cells broad, coalescing with the stem.

a. Cells on opposite sides of the stem.

Sertularia.

Dynamena.

Thuiaria.

a a. Cells unilateral.

Antennularia.

Plumularia.

Serialaria.

II. Base of the cells narrow, or pedunculated.

Campanularia.

Valkeria.

Cymodocia.

A A A. *Sheath membranaceous; the cells are the simple extremities of the branches.*—Tubulariadæ.

Tubularia.

Plumatella.

IV. Nuda.

Polypi naked, the mouth with marginal tentacula.

Coryna.

Hydra.

Latreille's method may next be noticed. He, following Lamarck, divides the animal kingdom into three primary sections, the last of which is denominated Acephala, which, with various other classes, includes all the Zoophyta. The Actinia and Lucernaria constitute a distinct class—*Helianthoida*—which is placed between the sea-stars (Echinodermata), and sea-jellies, (Acalepha), being superior to the latter and to zoophytes by their organization, in which Spix had detected a nervous system. The Polypes follow the sea-jellies, and are subdivided thus:

Order I. Brachiostoma.

Mouth encircled with tentacula, often retractile.

Family I. Calamides. Pennatula, Virgularia, &c.

——— II. Alcyonea. Lobularia, Alcyonium, &c.

——— III. Alveolaria. This family is portioned into *tribes.*

1. *Lamellifera*—the P. lamellifères of Lamarck.
2. *Foraminosa*—the P. foraminés of Lamarck.
3. *Corticifera*—the P. corticifères of Lamarck, with the genera Penicillus and Flabellaria.
4. *Reticularia*—the P. à réseau of Lamarck.
5. *Vaginiformia*—the P. vaginiformes of Lamarck.
6. *Spongites*—the sea and fluviatile sponges.

——— IV. Limnopolypi. 1. Tentacula retractile; a sheath—Plumatella, Cristatella, Difflugia. 2. Tentacula non-retractile; no sheath — Pedicellaria, Coryne, Hydra.

Order II. Trichostoma.

No tentacula at the mouth, which are replaced by rotatory organs or ciliæ.

Family I. *Cancriformia*—Brachionus, Follicularia, Tubicolaria.

——— II. *Campanulata*—Vorticella, Urceolaria, Furcularia.

——— III. *Caudata*—Vaginicola, Tricocercus, Ratulus.

Not having access to the original works, I must pass over the methods of Oken, and Van der Höven, the more willingly that they are but modifications, to no material extent, of one or other of those which preceded them, are in no respect preferable, and evolve no new principle, for surely the assumption on Oken's part that the orders, families, and genera in this class, as in the animal kingdom generally, are regulated by a law which throws them into quaternary sections—the number 4 exercising throughout a paramount influence—scarcely deserves this praise. It is different with the attempt of Rapp, Professor of Anatomy, at Tubingen, who in 1829 published a small work in German on the natural history of the Actiniæ. He proposed to divide the zoophytes, understanding the term in the same restricted sense that I do, into two great orders, the Exoaria and Endoaria,—the former producing their ova or reproductive gemmules form

the exterior, while in the latter "the ova are produced in the interior of the body, and are either conveyed outwards by means of oviducts which open by separate orifices, or they are discharged by the mouth." The distinction here first pointed out is a very important one, but in common with all single characters is of itself insufficient, and if rigorously adhered to leads to artificial and unnatural combinations. The Exoaria for example has all its members well and distinctly affined, embracing only three families, 1. the *Hydræ;* 2. *Corynea*, consisting of the genera Sertularia, Tubularia and Coryne ; and 3. *Millepora*, limiting probably this denomination to *M. truncata.* The Endoaria embraces a wider range —the *Alcyonea* equivalent to the Polypes tubifères of Lamarck; the *Tubipora;* the *Corallia* including the genera Corallium, Gorgonia, Isis, and Antipathes; the *Pennatulæ; Zoanthes;* and *Madrepores* with the subdivisions which have been introduced by Lamarck.* So far the order labours under little error, or is perhaps unexceptionable, but its definition would entitle us to place in it also the Escharidæ, the Cellepores, and Lymnopolypi, which are all very alien to the families which Rapp seems to have had too exclusively under his view.

The only other classification I shall notice is Blainville's— the most elaborate of any; and this author, as it appears to me, is the first who allowed the anatomy of the Polypes, abstractedly considered, to have its due influence on our systems. Notwithstanding, however, Blainville's unquestionable merits, his very defective acquaintance with species will ever prevent him becoming a first-rate systematist: he may sketch the outline, the details he cannot supply, and his attempt has exposed him to numerous errors: he is too fond of generalizations where his facts are few and specifical; he wants the necessary neatness and brevity of definition, and he evinces everywhere such a total disregard to the old nomenclature that his system is not likely to become popular, or to be generally adopted. Many of his alterations are excellent, and must meet the approval of all, for surely no one will

* See Edin. Journ. of Geogr. and Nat. Science, ii. p. 406, and Blainv. Man. d'Actinol. p. 59.

henceforth reinstate the apolypous sponges and vegetating corallines, which he has so properly separated, to a rank amongst proper polypes; and his removal of the Madrepores from the compound hydracolous polypidoms to a level with the Actiniæ seems to be equally judicious, and beyond future cavil.

System of H. M. D. De Blainville. (1834.)

Class—ZOANTHA.

Body regular, resembling a flower, more or less elongated, free or fixed, very contractile, furnished with an intestinal canal without distinct parietes, and with a single large terminal aperture encircled with multiform tentacula, always hollow, and in communication with the musculo-cavernous parenchyma of the skin.

The class is divided into three families:

The soft—Actiniadæ. Lucernaria, Actinia, &c.

The Coriaceous—Zoanthus.

The Calcareous—divided into 1. the *Madrephylliœa,* in which are the genera Turbinolia and Caryophyllæa; and 2. the Madrepores.

Class—POLYPIARIA.

Animals like the Hydra, viz. in general slender, furnished with a single series of filiform and not numerous tentacula, naked or contained in multiform cells (but never lamelliferous), clustered so as to form a polypidom very variable in shape and structure.

Sub-Class I. P. Solida.—Containing the family *Millepores,* of which there is no British genus amongst recent zoophytes; and *Tubuliporea* which contains Tubulipora only.

Sub-Class II. P. Membranacea—in which are the three families —1. *P. operculifera,* of which the British genera are Eschara, Retepora, Cellepora, Berenicea, Discopora, and Membranipora; 2. *P. cellariœa* containing Flustra, Cellaria, Tricellaria, Acamarchis, Bicellaria, Crisia, Gemicellaria, Unicellaria, Catenicella; 3. *Sertularicœa*—arranged thus:—

Cells	tubular, with a rounded aperture		Anguinaria. Tibiana. Tubularia.
	not tubulous,	campanulate	Coryne. Campanularia. Laomedea.
		rowed	Serialaria. Plumularia.
		paired	Sertularia. Biseriaria. Dynamena.
		denticulate, whorled	Cymodocia. Antennularia.
		denticulate, scattered	Thoa.

Sub-Class III. P. DUBIA—Cristatella, Plumatella, Alcyonella.
Sub-Class IV. P. NUDA—HYDRA.

Class—ZOOPHYTARIA.

Body rather large and somewhat variable in shape, furnished with a single circle of pinnated tentacula of determinate number; the ovaries internal.

Family 1. *Tubiporæa*—divided into two sections, (1.) envelope fleshy—with the genera Cuscutaria, which is the same as Valkeria of Fleming, Telesto, Cornularia, and Clavularia, of which last three we have no native species: (2.) envelope calcareous—Tubipora.

Family 2. *Corallia*—Corallium, Isis, Gorgonia, Eunicea, Primnoa, Antipathes, &c.

Family 3. *Pennatularia*—represented by Pennatula of Lin. with the various genera into which it has been portioned.

Family 4. *Alcyonaria*—Lobularia, Alcyonium, Cydonium, Pulmonellum, Cliona.

Type II.
AMORPHOZOA.

Bodies organized, animal, shapeless or without a determinate form, pierced with oscula and numerous pores, but without mouths or distinct individual animals, always adherent, and composed of a fibro-gelatinous substance, intermixed or not with calcareous or siliceous spicula, with internal buds or gemmules not localized.

This embraces the sponges only, divided into the following genera—Alcyonellum, Spongia, Calcispongia, Halispongia, Spongilla, Geo-

dia, Cæloptychium, Siphonia, Myrmecium, Scyphia, Eudea, Hallirhoa, Hippelimus, Cnenimidium, Lymnorea, Chenendopora, Tragos, Manon, Jerea, Tethium.

PSEUDOZOA.

Organized bodies not animal but vegetable.

Class I. Calciphytæ.

Family 1. *Corallinæ*—Corallina, Jania, and Flabellaria are British genera.

Family 2. *Fucoideæ*—of which there are no native examples.*

The researches of Professor Grant, (1827) and of Milne Edwards, (1828) into the anatomy of the Flustræ, and the establishment of the class Polyzoa, by Mr. J. V. Thompson, were important steps towards a better and a physiological classification, although their bearing was not recognised by the leading systematists of the day. It was a proof of Ehrenberg's clearer views of their great difference in structure when he divided zoophytes (1834) into two grand sections, the Anthozoa and Bryozoa,—the latter name synonymous with the Polyzoa of Thompson, with whose works, as well as with those of Andouin and Milne Edwards, Ehrenberg was unacquainted. It is unnecessary to give his definitions of these classes, for they are essentially the same adopted in the body of this book; but in Ehrenberg's system many groups are misarranged, and placed in the class to which they do not belong. Ehrenberg has, however, introduced several ingenious views and important systematical changes;† and his essay

* It appears that Blainville soon found reason to alter this arrangement, and he now adopts one very similar to that followed in this work, dividing the class Polypiares into four sub-classes,—"les Hydriens, les Alcyoniens, les Actiniens, et les Polypes douteux."—See Ann. Nat. Hist. iii. p. 47.

For Mr. J. Hogg's classification of Zoophytes, founded on structural peculiarities of the tentacula, see the Annals of Nat. History, vol. iv. p. 366 (1840).

† An outline of the classification of Ehrenberg. (1834.)

CURALIA.

A. Anthozoa.

Ordo I.—Zoocorallia.

Tribus I.—Zoocorallia polyactinia.

Familia I.—Actinina.

II.—Zoanthina.

III.—Fungina.

Tribus II.—Zoocorallia octactinia.

IV.—Xenina.

V.—Tubiporina.

on the corals of the Red Sea cannot but be reckoned amongst the most valuable contributions to zoophytology.

Milne Edwards gave at first no classical name to the ascidian zoophyte of the Flustræ; and on his return to the subject, he adopted that of Ehrenberg, as well as the name Anthozoa for the radiated polypes. Of both classes he appears to have had, even at this date, a very definite knowledge, but the latter class only was subjected by him to further division, being reduced to three natural and clearly discriminated orders, viz. the Sertulairiens, the Alcyoniens, and the Zoantaires.*

It was also at this period (1836†) that, to mark decisively their structural differences, and their real relationship to the other classes of invertebrate animals, I named the primary sections of zoophytes the *radiated* and the *molluscan*. The latter were embraced in one order, the *Z. Ascidioida*, a name intended to point out its immediate affinity with the mollusca tunicata; and the radiated zoophytes were divided into three orders, the same as those of Milne Edwards, but designated

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VI.—Halcyonina.
VII.—Pennatulina.
TRIBUS III.—ZOOCORALLIA OLIGACTINIA.
VIII.—Hydrina.
IX.—Tubularina.
X.—Sertularina.
ORDO II.—PHYTOCORALLIA.
TRIBUS IV.—PHYTOCORALLIA POLYACTINIA.
FAMILIA XI.—Ocellina.
XII.—Dædalina.
TRIBUS V.—PHYTOCORALLIA DODECACTINIA.
XIII.—Madreporina.
XIV.—Milleporina.
TRIBUS VI.—PHYTOCORALLIA OCTACTINIA.
XV.—Isidea.
XVI.—Gorgonia.
TRIBUS VII.—PHYTOCORALLIA OLIGACTINIA.
XVII.—Alloporina.

B. BRYOZOA.
ORDO I.—THALLOPODIA.
FAMILIA I.—Cristatellina.
II.—Halcyonellea.
III.—Cornularina.
IV.—Escharina.
V.—Celleporina.
VI.—Auloporina.

* Lamarck's Hist. Nat. des Animaux sans Vertèbres. Deuxième edition. 1836. Tom. ii. p. 105.

† Magazine of Zoology and Botany, vol. i. p. 447.

the *Hydroida*, *Asteroida*, and *Helianthoida*, names which have been adopted by British naturalists in general.

Very recently it has been proposed to divide our radiated zoophytes into two classes, the *Hydrozoa*, equivalent to the order Z. Hydroida, and the *Anthozoa*, which is made to include the orders Asteroida and Helianthoida.* The proposal seems to me a retrograde step in classification ; and in this edition of my work I adhere to the system adopted in the first, with a very few and immaterial changes. To the primary sections I have given the names to which they are entitled on the claims of priority ; and I have followed the suggestion of M. Gervais in dividing the ascidioida or polyzoan tribes into two orders, the constituents of one being entirely marine, while those of the other are as exclusively the denizens of fresh water.

"And now, should it be asked, granting all this to be true, to what end has so much labour been bestowed in the demonstration? I can only answer, that as to me these disquisitions have opened new scenes of wonder and astonishment, in contemplating how variously, how extensively life is distributed through the universe of things : so it is possible, that the facts here related, and these instances of nature animated in a part hitherto unsuspected, may excite the like pleasing ideas in others ; and in minds more capacious and penetrating, lead to farther discoveries, farther proofs (should such be wanting), that One infinitely wise, good, all-powerful Being has made, and still upholds, the whole of what is good and perfect ; and hence we may learn, that, if creatures of so low an order in the great scale of nature are endued with faculties that enable them to fill up their sphere of action with such propriety ; we likewise, who are advanced so many gradations above them, owe to ourselves, and to Him who made us and all things, a constant application to acquire that degree of rectitude and perfection, to which we also are endued with faculties of attaining."—*Ellis.*

* Owen's Lectures, p. 86, 87. Lond. 1843.

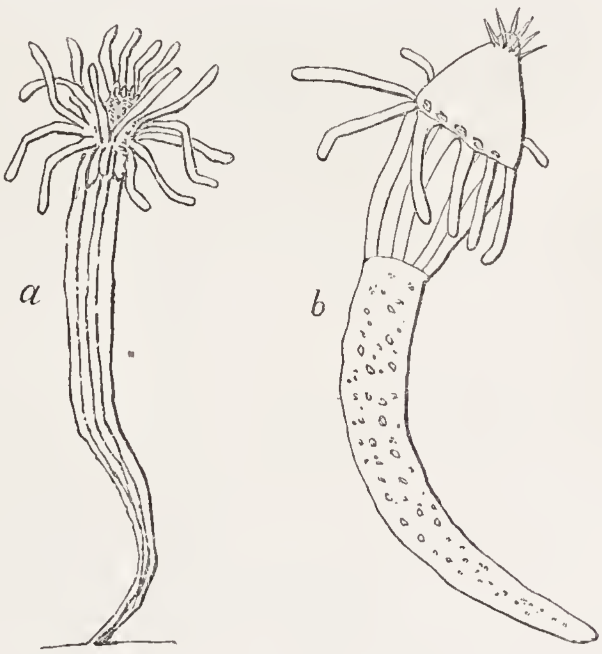
SUPPLEMENT.

ANTHOZOA HYDROIDA.

Family—Corynidæ.

In June 1843, I received from Joshua Alder, Esq., of Newcastle, the figure and description of a Zoophyte which may, perhaps, be referable to the genus *Hydractinia,* but is evidently distinct from any described species, and indeed from any polype known to me. The Zoophyte in question (Fig. 79, *a.*) was found at Newbiggin-by-the-sea, on the coast of Northumberland. "It is similar in the head to a Tubularia, but, instead of a tube, it has a fleshy transparent stalk, about half an inch long, with white longitudinal lines. It is attached at the base, and swells in the upper portion when contracted. Is Tubularia ever without a tube in any stage of its existence? I know Coryne squamata: it is not that."

Fig. 79.



Sars has lately characterised the genus Hydractinia under the name of *Podocoryna.* Fauna littoralis Norvegiæ, i., p. 4. His P. carnea is evidently the same as the Hydractinia rosea of Van Beneden.

Family—Tubulariadæ.

Professor Reid of St. Andrews, has communicated (Nov. 1845) an account of a zoophyte nearly related to *Corymorpha.* (Fig. 79, *b.*) "It was about an inch in length, and of a pale fawn colour through-

out. It was unattached by any stalk, and was fixed to some sea-weed. The lower part, which looks like a stalk, was soft, and it did not adhere to the sea-weed by its apex. The upper part of the stalk, immediately below the head, was marked by longitudinal lines; the lower part was dotted over with little spots. The tentacula were arranged in two rows; ten in the lower row, with an equal number of short club-shaped ovarian ? tubercles at their bases. The part above the inferior tentacula was constantly changing its form, and the currents described by Mr. Lister in Tubularia indivisa were very distinctly seen; the circulation or motion of the contained water was not observed in the stalk-looking portion." *Prof. John Reid.*

Family—Sertulariadæ.

Antennularia ramosa, p. 88.

On A. ramosa there are two trumpet-like processes placed, in regard to the cells, similarly to those of Plumularia Catherina, as described in a subsequent note. These processes are the analogues to the birdsheads and beaks upon the Cellulariæ and Lepraliæ. *F. W. L. Thomas,* R. N.

Plumularia (p. 89) echinulata.

Pl. *pinnate, the pinnæ alternate, one from each internode; cells entire, remote; vesicles ovate, echinated.* (Fig. 80.) C. W. Peach.

Plumularia echinulata, *Lam.* Anim. s. Vert. ii. 126: 2de edit. ii. 162. *Blainv.* Actinol. 477.

Hab. Harbours and estuaries, parasitical usually on Chorda filum and Zostera marina. From an anchor in the Solwent, Isle of Wight: quite common in Southampton water on Zostera: Fowey harbour, not uncommon. *C. W. Peach.*

This small and delicate species closely resembles Plumularia setacea, from which it can be distinguished certainly by its ovarian-vesicles only. These are roughened over with spines arranged in rows on elevated striæ or ribs, but the rows, in dried specimens, are obscurely marked. They are ovate, sessile, erect, and are copiously produced from the trailing root-fibres, and also from the pinnæ, so copiously indeed, that the polypidom is sometimes almost hidden by them. The pinnæ arise from near the upper part of the joints, and curve outwards as usual, bearing, on their upper side, the polype

cells, between which there is a small denticle. The vesicles are spinous both when filled with ova and when empty. Mr. Peach has observed it from September to December laden with them, and has found them to be constant to their character,—hence the species is probably a good one. It is one of Mr. Peach's interesting additions to our Fauna ; and from his letters and drawings I have taken my account of it.

Fig. 80.

Fig. 81.

Plumularia pinnata, setacea, and echinulata have this in common, that they often produce a great number or a mass of entangled root-fibres, and vesicles pullulate from these more abundantly by far than from the rachis of the polypidom. Herein these species resemble the allied Campanulariæ. Mr. Busk has sent me a very neat drawing of Plum. setacea in this state. (Fig. 81.) The specimens were attached to Chorda filum, and on looking over a great many Mr. Busk could not find one with axillary vesicles on the rachis, while they were in profusion on the non-polypiferous fibres. "The vesicles also do not appear to be quite smooth, but to have probably four protuberances near the summit." *Busk* in lit. Sept. 26. 1846.

Plumularia Catharina, p. 97.

"In P. Catharina there is a cell upon every alternate joint : on the internode there are generally two cellules : that which bears the cell has also a cellule at its base, and two *lateral* processes about the

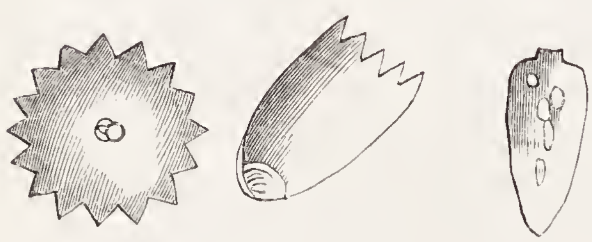
middle: to these processes are articulated two 'trumpets,' whose height is equal to the mouth of the cell. The terminations of the pinnæ have four of these trumpets, but, according to my observations, the cellules never bear them." *F. W. L. Thomas*, R. N.

Family—Campanulariadæ.

Laomedea dichotoma, p. 102.

"In working up the zoophytes collected by me last summer, (1846,) I have convinced myself of a fact, of which I had previously a strong suspicion, viz., that the margin of the mature cells in Laomedea dichotoma is always crenulated. The crenulations are shallow (the upper or left hand cells of Van Beneden's figure of C. volubilis are portraits of them.) The crenulations are sixteen, equal to the number of the tentacula in the polype. My specimens are of the normal kind, which abound everywhere in the Firth of Forth. I am well aware of the host of authority against me on this point, and which has made me for a long time dubious; but the careful examination of hundreds of cells, alive, dried under pressure, and preserved in Goadby's solution, has quite convinced me. I presume that the reason why the crenulations have so long escaped detection, is, that it is difficult to see *any* margin, for the cells when compared with those of C. volubilis hold the same relation with regard to tenuity that demy does to pasteboard. This is not all connected with them —a horizontal section of the upper half of the cell would not be an even or true circle, but a crenulated one, or in other terms, the upper half is obsoletely ribbed, the ribs or ridges being sixteen in number. —Of the following I am not so positive. This zoophyte was among the first which I examined microscopically, and when doing so I witnessed the extrusion of the embryo — Struck with the singularity of the event, of which I had no previous idea, I made a sketch of it upon the margin of your work (by which I was endeavouring to determine the species). I send you a copy of it, (Fig. 82) by which you will see that it differs very much from those figures previously published; but shipboard is about the worst of places for the micro-

Fig. 82.



scope, and so I leave it still an open question. As for the embryo of L. geniculata, I have seen it scores of times, and your wood-cut No. 25, is identical with my sketch of it. The tentacula were twenty-four in number." *F. W. L. Thomas*, R. N.

Localities, &c. of some Zoophytes upon the North and East Coasts of Britain. By Lieut. F. W. L. Thomas, R. N.

Clava multicornis—two fms. Kincardine, River of Forth, on Sabellaria, associated with T. Larynx, C. ciliata, &c.

Hydractinia echinata—on old shells, from Estuary of Thames to Orkney Isds. The polypes are in a single whorl upon the muricated papilla, and arise from a little above the base.

Coryne pusilla—*α*, small, grey, heads ovate. Orkney Isds. (about $\frac{1}{4}$ inch high.) *β*. larger, polypidom wrinkled throughout (=C. ramosa?) Orkney Isds. *γ*. deep sea; heads pink, subcylindrical. Yorkshire. The polypidom of this species closely resembles the creeping variety of C. dumosa.

Eudendrium rameum—forty-five fms., muddy bottom, off Tynemouth: rej. F. of Forth. (rare to me).

Eudendrium ramosum—Coast of Suffolk, Northumberland, Aberdeenshire, River of Forth, Orkney Islands. This extensively distributed zoophyte has been found from a depth of forty fms. in the open sea to the half-tide mark upon Alloa pier, River of Forth, where the water is often sufficiently fresh to be drinkable. The polypidom is constantly black, or of a dark-brown colour. I believe that this and the rest of the Tubulariæ periodically lose their heads. At Alloa none were found with "heads" on in the month of November.

Tubularia indivisa—Es. of Thames to Orkney Isds. Forty-five fms. to litt. On the oozy bottom which lies outside of a line drawn between Flamborough head and the Staples, this zoophyte grows to a very large size, and is there associated with E. rameum, Plumularia frutescens, Pennatula, Virgularia, &c. The experiment was made of placing it in fresh water directly on taking it from the sea, but no immediate effect followed. In some a red mark half-way or one-third down the tube showed the presence of the heir to the crown, though the incumbent seemed in robust health.

Tubularia Larynx—everywhere, in brackish water at Kincardine,

R. of Forth to forty fms. deep sea, and fifty fms. off Troup head, Aberdeenshire.

Halecium halecinum—four fms., eight fms., Est. of Thames, four fms. Coast of Suffolk, eight fms. Wold, Coast of Norfolk, in fine perfection in March 1846. Thirty-five fms. Coast of Yorkshire and Northumberland, April 1845, with ovaries, Est. of Forth, Aberdeenshire. Thirty-five fms. Copinsha, Ork. Isds., May 1845, without ovaries. From these observations it would follow, that those individuals which inhabit shallow water, spawn before those in the deep sea.

Sertularia polyzonias—fifteen fms. Dimlington, thirty-five fms. Huntly Foot, April 1845. Thirty-five fms. off Copinsha, May 1845, all without ovaries; but it was found littoral in Papa Westra, Ork., with ovaries, in August 1845. All littoral individuals or species must be "forced" exceedingly, for when the sun is out upon a summer's day, the water in the pools left by the receding tide, becomes almost hot enough to boil them.

Sertularia rugosa—fifteen fms. Dimlington, two species, unless all the cells occasionally become developed into ovaries. All my specimens have the cells distant and without ovaries. Orkney, &c., May and April, except one, in which the cells are crowded, and have the cells ? three times larger than is usual.

Sertularia rosacea—this species is always found by dredging from Thames to Orkney, but presenting some difference of habit; those from the Southward being more opaque and erect than those from deep water from the Northward; in short, the Southern kinds are corneous, the Northern membranaceous.

Fig. 83.

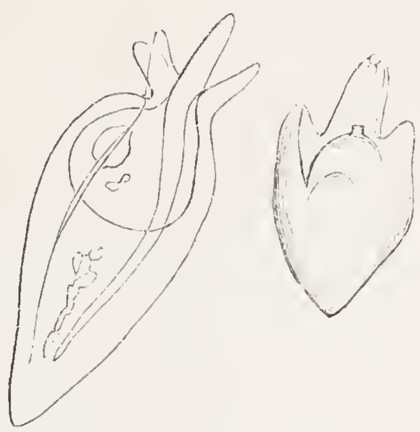
In the latter, the walls of the cell induplicate, &c. The ovary (Fig. 83) presents a very different appearance at different stages

of its growth. When very young (a) the vesicle is pear-shaped, with a rim round its greatest circumference, upon which are eight small tubercles. Within the rim is a dome divided from the apex into four segments. As it increases, the tubercles elongate to laminar spines, which bend inwards (b). At this period it may be seen that the interior of the vesicle is divided into two chambers ; the lowermost, which contains the ovarian column is of the shape of a sugar-loaf reversed. The upper chamber is larger and dome-shaped, and both are separated by a valve or septum marked with concentric circles. When the ovary is perfected, two of the spines are erect, larger than the rest, and have a notch or bracket upon the outer edges ; the others are either folding upon one another, or stand erect. The ovary is also seen to be fluted upon its eight sides. After the escape of the ova, the segment of the dome and laminar spines are all erect, and have a very crowded appearance : the long spines break off, or all of them, till at last nothing may be left but an eight-sided fluted reversed pyramid, with a level top.

Sertularia pumila—α. robust ; on Laminaria, Orkney Isds. β. slender, cells distant ; on filamentous algæ, Humber.

Sertularia fallax—thirty-five fms. Orkney Islands. Forty fms., Buchanness, June 1846. The immature vessels are quadrangular, with four small tubercles upon the angles, and a tubular papilla at the top ; in fact you will find upon the upper or lowest pinnæ of those I send you, ovaries from which your Fig. 12 might have been taken. From this circumstance I had supposed that S. pinnaster had been founded upon an unripe specimen of S. fallax, and such may still be the case, but more anon. The general features of the growth of the vesicle are like those of S. rosacea ; like that species, the interior is divided into two chambers ; the tubercles become ramillæ, which at first fold over the dome-shaped top, and afterwards become erect. The colour of this species varies from hyaline to a light claret.

Fig. 84.



SERTULARIA PINNASTER—After assuring myself that S. pinnaster had been founded upon an unripe specimen of S. fallax, I commenced the examination of the S. rosacea from the same locality and from which the above descriptions of the vesicle were made, but there was another bunch from the rocky bottom of Stronza Firth, Orkney Isds., found growing upon Delesseria sanguinea which I cannot believe to be the same species. There is no difference between this and S. rosacea in the habit of the polypidom, nor in the structure or shape of the cells, but the ovaries are totally distinct. (Notwithstanding the differences in the ovarian vesicle, I consider these specimens as belonging to S. rosacea. G. J.)

SERTULARIA TAMARISCA }
SERTULARIA MARGARETA } In April 1845, a small polypidom came up off Huntly Fort, without vesicles, which I did not hesitate (by the help of your first edition) to call S. tamarisca. In June 1846, a fortunate haul off Buchanness brought up four fine specimens in full blow. Intending to examine them beneath the microscope, they were placed with the rest in a bucket of sea-water, but bad weather coming on, I was glad to secure them by putting one into a phial of Goadby, and the rest were dried under pressure. On my return home I procured your second edition, and commenced the arrangement of the Zoophytes. When the bottle specimen is examined the vesicles are seen to be crowned with spines, and it is named S. Margarita. Wishing to trace the development of the vesicle in the species, the others procured at the same time and upon the same attachment were soaked in water, when every vesicle presented the character of S. tamarisca. Are these different species? or is the shape of the vesicle of no specific value? These are the characters of S. tamarisca and of that of the crown of spines. Polypidom erect, pinnate, sparingly branched; Cells opposite, tubular, upper half divergent and free, aperture tri-crenate, the crenations filled up by a triangular flexible membrane, the edges uniting when the animal retires to form an operculum. So far the two species are identical. Ovary (of one of the specimens) arising from a short stalk, thence gradually increasing for half its length. The upper part is crowned by laminar spines diverging in three rows from the centre—the exterior spine is bifid.

SERTULARIA FUSCA—quite young in March 1846, in thirty-five f. off Staples. Generally attached to stones. Many old fronds off

Buchanness upon which were growing S. fallax, S. rosacea, S. tamarisca, &c.

S. ABIETINA—with ripe ova in May 1845, off Southwold, and Huntly Foot, forty fms. Noss head, Copinsha, &c.

SERTULARIA FILICULA—with scattered ovaries off Tynemouth, in May, 1845—do. off Buchanness in forty fms. on shingle, off Copinsha, &c.

SERTULARIA OPERCULATA—almost always on stems of Laminaria dig.—Suffolk, Orkney, &c.

SERTULARIA ARGENTEA—gregarious upon stems of L. digitata.—Suffolk, Yorkshire, &c.

SERTULARIA CUPRESSINA—generally solitary upon shells and stones. The stems are sometimes two feet long and nearly bare of pinnæ, from which other long straggling polypidoms spring out. The embryo is a disk with a central nucleus—escaping in Dec. 1845, Est. of Thames. F. of Forth, Orkney Isds., &c.

THUIARIA THUIA—not been found in fruit in March, April, or June—off Staples, Yorkshire Coast, Inchkeith, Buchanness, Orkney Isds, &c.

THUIARIA ARTICULATA—taken from a muddy bottom in forty fms. in April 1845, off the Tees.

ANTENNULARIA ANTENNINA—Suffolk, Yorkshire, Buchanness, Orkney Isds, &c.

ANTENNULARIA RAMOSA—this species has the lateral trumpets—with the preceding—with ova in seven fms. Kirkwall, Orkney Isds., July 1846.

PLUMULARIA FALCATA—generally distributed.—It is worthy of remark, that on a voyage from Thames to Scotland, in March 1845, not one specimen was taken with ova, while all those in the Firth of Forth, were covered with them.—Earliest in shallow water?

P. CRISTATA—on Halidrys siliquosa (has it ever been found otherwise?) with ova in August 1845. Westra, Orkney Isds.

P. PINNATA—Yorkshire coast to Orkney Isds.—It has never been found in fruit—but my dredging has been confined principally to spring months. Is not the spine beneath the cell, a broad, transparent cellule?

P. SETACEA—associated with the preceding—Yorkshire coast thirty-five fms. Aberdeen do. Copinsha. Fifteen fms. Stronza Firth. Constantly with ova in May and June.

P. CATHERINA—Yorkshire coast thirty-five fms. Aberdeenshire do.

Generally upon Ascidia, in fine fruit off Aberdeen June 1846, also in Orkney. Those in Goadby are from Buchanness.

P. FRUTESCENS—from muddy bottom in forty-five fms. off the Tees, in April 1845, and again in March 1846, both times with ovaries.

LAOMEDEA DICHOTOMA—I send some from Firth of Forth, and another species, which closely invests old polypidoms of A. antennina or T. indivisa, from Estuary of Thames. Both species have crenulated margins, the southern more distinctly so. Before the rupture of the operculum the markings of the future crenations have been observed upon the walls of the cells. It is unnecessary to repeat here what I have said in a former letter.

LAOMEDEA GELATINOSA—α—with even margins and simple stem (not seen by me,) β—with crenulated margins, and simple stem. γ—with margins, and compound stem. The second species or variety occurs in thirty-five fms. off Yorkshire coast. Forty fms. Buchanness, and four fms. Kirkwall Bay. The third variety is from thirty-five fms. off Copinsha, but the cells have not been examined.

LAOMEDEA GENICULATA—Orkney Islands, &c., generally upon Laminaria, but sometimes upon rocks. This species, of all the Laomedea, is the most constant to its character, its circumflexuose (not angularly bent) stem and short pedicles, with entire margins to the cells distinguish it at once. Is not Van Beneden's C. geniculata—L. dichotoma of Firth of Forth? I have sent sketches of the embryo already.

CAMPANULARIA VOLUBILIS—Estuary of Thames to Orkney Islands. It is usually found upon Laomedea dichotoma. F. of Forth, when the difference in the thickness of the cell-walls is well seen by contrast.

CAMPANULARIA SYRINGA—Thames to Orkney Isds. The operculum is eight-sided. N.B.—The operculum of S. tamarisca is formed in the same manner, but is of only three sub-rhomboidal pieces.

CAMPANULARIA VERTICILLATA—in fine fruit, in June, Firth of Forth, 1846—very large off Copinsha (nine inches).

CAMPANULARIA DUMOSA—α, erect, irregularly branched—cells sub-sessile. β, erect, distichous—branches secundate—falcate—cells upon once-twisted foot-stalks, four completing a whorl, and so disposed as to form four nearly perpendicular rows upon the branch (specimens sent in 1845). γ, creeping-cells sub-sessile.

HYDRA VULGARIS, p. 122.

"*Aug.* 20*th*, 1846.—I saw to day in Mr. Hyndman's possession, attached to the sides of a glass globe, such as is used for gold-fish, half filled with water, about twenty living *Hydræ* of this species. The tentacula were larger than the body, not attenuated below, and six in number in all the individuals. They were of about the same length as the body (five lines) when it was fully extended, and of the same colour; a very pale reddish-brown. They were taken in the month of May last, from the pond bordering the Zoological Gardens, Phœnix Park, Dublin. Mr. Hyndman has observed that the moment the tentacula of a *Limneus pereger* touched the arms of one of these *Hydræ*, the mollusk suddenly drew back, and changed its course, while the Hydra remained immovable. A *Planorbis marginatus* (about half-grown) was observed to be similarly affected on coming in contact with the arms of the Hydra, but there was no shrinking on the part of either mollusk from contact with the body of that animal. The tentacula alone would thus seem to possess the paralysing power." *W. Thompson.*

ANTHOZOA HELIANTHOIDA.

TURBINOLIA BOREALIS, p. 196.

Off the Cornish coast, Professor Edw. Forbes, and Mr. Mac Andrew, dredged a specimen of the normal state of *Caryophyllea Smithii*, "having a smaller specimen attached exhibiting the form of *Turbinolia borealis*, and proving their identity. I do not think the Turbinolia-form of Caryophyllia is produced by absorption of the base, but simply by the germ having fixed itself on a very small surface, as a grain of sand; or, as in the present instance, having attached itself to the side of the parent." *Edw. Forbes*, 25th Aug. 1846.

"At page 201, you notice the CARYOPHYLLIA RAMEA as being sometimes found on the Cornish shores. This I have several times dredged up, but always dead; and having the appearance of having been in a museum, I am quite convinced that they are not natives of our seas. I have also secured two specimens of Tubulipora musica, one quite red, the other faded and injured, but both having the appearance of previous preservation."

R. Q. Couch.

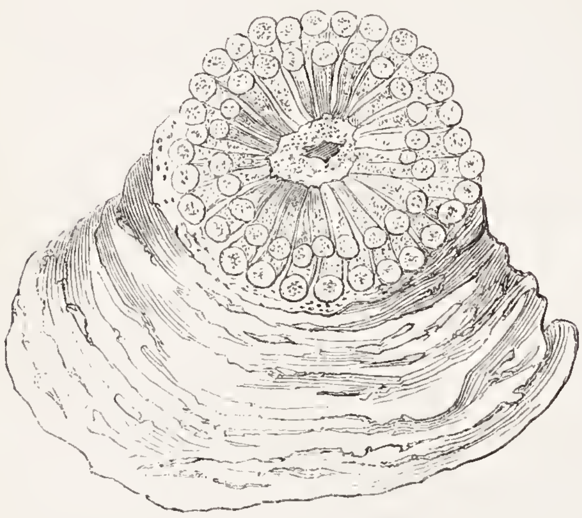
Corynactis Allmani,* Thompson.

Spec. char. C. with four concentric rows of short capitate tentacula; those of the third and fourth rows being about equally regular and numerous as those of the two outer rows; tentacula between the fourth row and the mouth irregularly disposed. Fig. 85.

Hab. Deep water, attached to shells, &c. Belfast bay, 6—10 fathoms, August 1844. Strangford Lough, 15—20 fathoms, June 1846.

The *form* is so varied that a good idea cannot be given of its size; but to give some notion of this, it may be described as being rather under half an inch in breadth and height. The *colour* of the body is pale coral red; tentacula flesh-colour, a little streaked, and dotted with bright red: the tentacula being fully expanded, six white rays are seen diverging at regular intervals from the mouth to the margin of the disk, towards which they become gradually broader; they divide it into six equal spaces. Such is the colour when this individual is free from all adventitious matter; but when it was taken, and for two weeks afterwards, all of its body except the extreme base and upper portion, was of a dull brown colour, produced by a coating of extraneous matter such as certain species of *Actiniæ* assume: this cast off, the body is smooth. During the four weeks that I kept this *Corynactis* alive, it was once observed to protrude from the mouth—as some *Actiniæ* do—membraneous lobes, which were pellucid, faintly blushed with pink, and adorned with white lines extending from the mouth to the margin; these lobes were so large as wholly to occupy the disk when the animal was fully expanded.

Fig. 85.



The preceding description is drawn up from a single specimen, dredged in Strangford Lough on the 22nd June, 1846, by Mr. Hyndman and myself. Having kept it alive in sea-water, I re-

* Named in honour of the founder of the genus, for which see Annals of Natural History, June 1846, p. 417. (Vol. xvii.)

marked the differences between it and *C. viridis*, described by Professor Allman in the Annals of Natural History, published on the 1st of the same month, and when the July No. of the work appeared containing figures of the species, they were so different from my specimen in the extremes of form represented, and which it was believed it could not possibly assume, that it was submitted—in a living state —to that gentleman's opinion, and considered by him as certainly distinct in species from *C. viridis.* The differences, whether they eventually prove to be specific or not, may be pointed out as existing in the *tentacula*, those of the 3rd and 4th rows being more numerous and regular than in *C. viridis* ; and however great its changes of *form*, they are much less Protean than in that species (see figures of *C. viridis**). The *colour* is very different, but with our present knowledge, I am unwilling to lay any stress on this. The *habit* of enveloping the body in an adventitious covering, was never observed in any of the numerous individuals of *C. viridis* that came under Professor Allman's notice. These too were taken "near low-water mark, in the pools left by the retiring tide," while both the specimens of *C. Allmani* were dredged from a considerable depth, which has already been particularized. The specimen taken in Belfast bay being at once put by its captor (Mr. Hyndman) into spirits, prevented any description being drawn up from it.

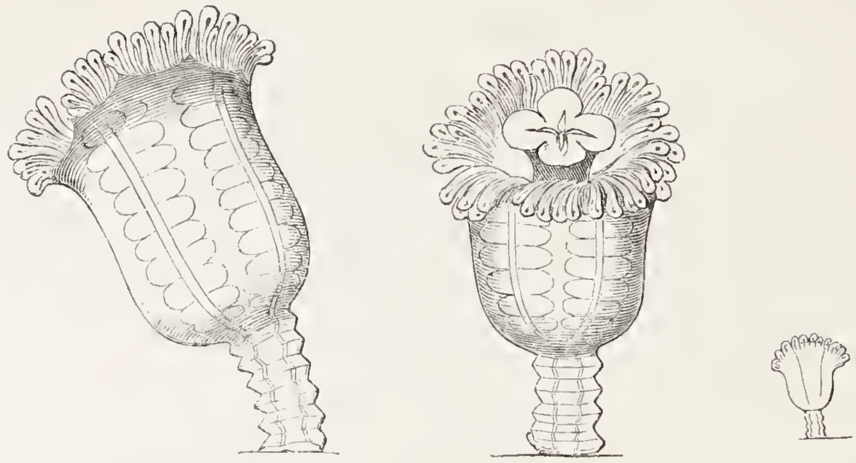
Family—Lucernariadæ, p. 244.

Lucernaria cyathiformis, "semipollicaris, stipite disco circulari repando sese affigente ; corpore cyathiformi, margine dilatata, repanda, circulari, integra (s : non in radios divisa), tentaculifera, tentaculis sæpissime in fasciculis 8 fere continuis ad marginem corporis dispositis ; organis generationis 8, binis approximatis."—*Sars* Faun. lit. Norveg. no. i., p. 26, tab. 3, fig. 8—13.

Some time ago I received from Mr. Joshua Alder a drawing (Fig. 86) of a Lucernaria, the same as that characterized above by Sars. It was found by Mr. David Landsborough in the south of Arran. In its structure and substance it resembles the other Lucernariæ. The tentacles are arranged in eight tufts round the interior of the disk, and probably they are extended beyond it when the animal is alive. It wants the produced arms of the typical Lucernariæ.

* The ordinary form of *C. Allmani* resembled that of Kapnea, represented in the Annals Nat. Hist. vol. vii. pl. 1, fig. 1, *a.*, and 1, *b.*

Fig. 86.



M. Sars reduces the Lucernaria quadricornis of Muller, and the L. fascicularis of Fleming to one species, a conclusion at which Mr. Alder had almost arrived. See p. 252.

Sars doubts whether I am right in making the Luc. convolvulus, *Johns.* synonymous with the Luc. campanulata, *Lamour.*; and he complains of the imperfection of my description of the species. This I regret that I cannot amend nor render more complete. The species is liable to considerable variation. May there not be awanting in M. Sars the faculty of apprehending the written characters of a species? Some good naturalists are defective in this faculty, and hence their constant reference to figures, and their inordinate estimation of their value.

POLYZOA INFUNDIBULATA.

Eucratiadæ.

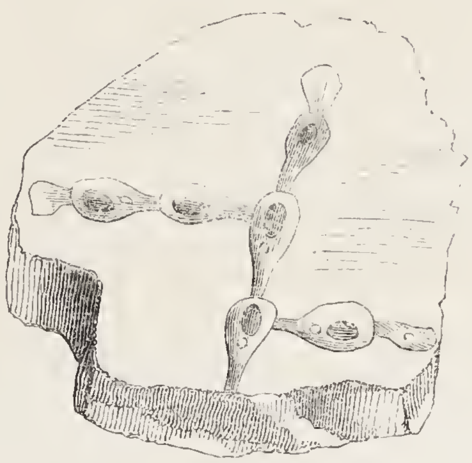
Hippothoa (p. 291) cassiterides, *Couch.* (Fig. 87.)

"H. *encrusting, calcareous; cells ovoid, connected to each other by a short stout thread; openings nearly round, with thickened rims; a short distance from the proximal lip is a small pearly tubercle.*" R. Q. Couch.

Hab. "On a stone between the Scilly Islands and the Lands-End. This species I found on a bit of stone dredged up off the Lands-End. The number of perfect cells is six, with a few others partially developed. Their general appearance is that of *H. lanceolata,* but under a lens, other characters appear which indicate a distinct species. The cells are stouter and more pear-shaped, and the threads of connection shorter and stouter, being about one-third the length,

and one-fourth the breadth, of the cell. The mouth is longitudinally oval, rather large, and with a thickened rim. At a short distance from the proximal lip is a small pearly tubercle, which is larger in one cell than in another. The branching is at right angles, and the cells arise immediately opposite the mouth."

Fig. 87.



"This tubercle is very different from anything ever observed in *H. lanceolatum*, and constitutes it a distinct species." *R. Q. Couch.*

Gemellaria loriculata, p. 293. The aperture in the cell through which the polype extrudes its tentacula, is formed by a valvular membrane with a transverse slit. It is comparatively small. There is "also a remarkable orifice at the back part of the cell; probably through it the polype is connected with the vital axis. Upon a very few cells is a small adnate tube, with a spreading tip on the anterior side. I could not determine whether it was extrinsic to the polypidom or not." *F. W. L. Thomas,* R. N.

Celleporidæ.

Lepralia Hassallii, p. 304. "This is, I fancy, more like a Cellepora, from the cells being heaped upon each other, like C. pumicosa. I find it plentiful on various algæ, especially on the roots of Laminaria digitata." *C. W. Peach.*

Mr. Thomas has arrived at the conclusion that the Lepraliæ in general possess the "Bird's head processes;" but in them, "the skull is downwards, and the movable bill uppermost;" that those which have the largest ovaries have the bills most developed; that the position of these organs is variable in different species, and will present the best specific characters, and they are not (?) present on those in-

dividuals which do not bear ovaries, at least such as have fallen under my observation have them not." *F. W. L. Thomas*, R. N. 19th Feb. 1847.

Lepralia punctata, p. 312. In a recent letter from Mr. Peach he tells me that, for the first time, in a very young specimen, he had seen a pair of spines in a central cell, and also the stumps of other spines in more cells. Being very delicate they are destroyed as the Lepralia grows, and when the ovarian vesicles are developed.

Membranipora membranacea, p. 328.

When once known, M. membranacea is easily enough recognised again, but I have found it difficult to form a correct idea of the shape of its cells. In a recent and good specimen I found the cells on the margin of the crust to be rhomboidal (or like a coffin), the wall of the posterior part of the cell calcareous and arched, while the anterior and larger part was covered by a flat membrane with a transverse aperture in front for the exit of the polype. The septa were plain, but in older cells there are two short processes on the septa. Before the aperture there is frequently a purse-shaped and calcareous ovary; and in the space between the cells, on each side of the aperture, there is a prominent and open loop.

I have stated at p. 316, that *Flustra Peachii* of Couch is a state of Lepralia pediostoma, and that it is sometimes so I am still satisfied, although Flustra Peachii may be also a state of other Lepraliæ. Mr. Peach, who thinks it a good and permanent species, has sent me a specimen and drawing of it in its best condition; and this specimen I would unhesitatingly refer to *Membranipora membranacea*.

POLYZOA HYPOCREPIA.

Alcyonella stagnorum, p. 391.

"I have this summer found Alcyonella very plentifully about Norwich, and in two or three cases have found specimens with the tentacula *circularly* disposed, where, on the same branch, others were of the usual depressed form." *Thos. Brightwell*, 17th Nov. 1846.

INDEX TO THE WOOD-CUTS.

ERRATA.

Page 25, last line, *after* "luminous" *add* "from iridescence."
„ 73, line 15, *for* "vesticles" *read* "vesicles."
„ 172, line 34, *for* "nominally" *read* "normally."

INDEX.

THE END.

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